JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

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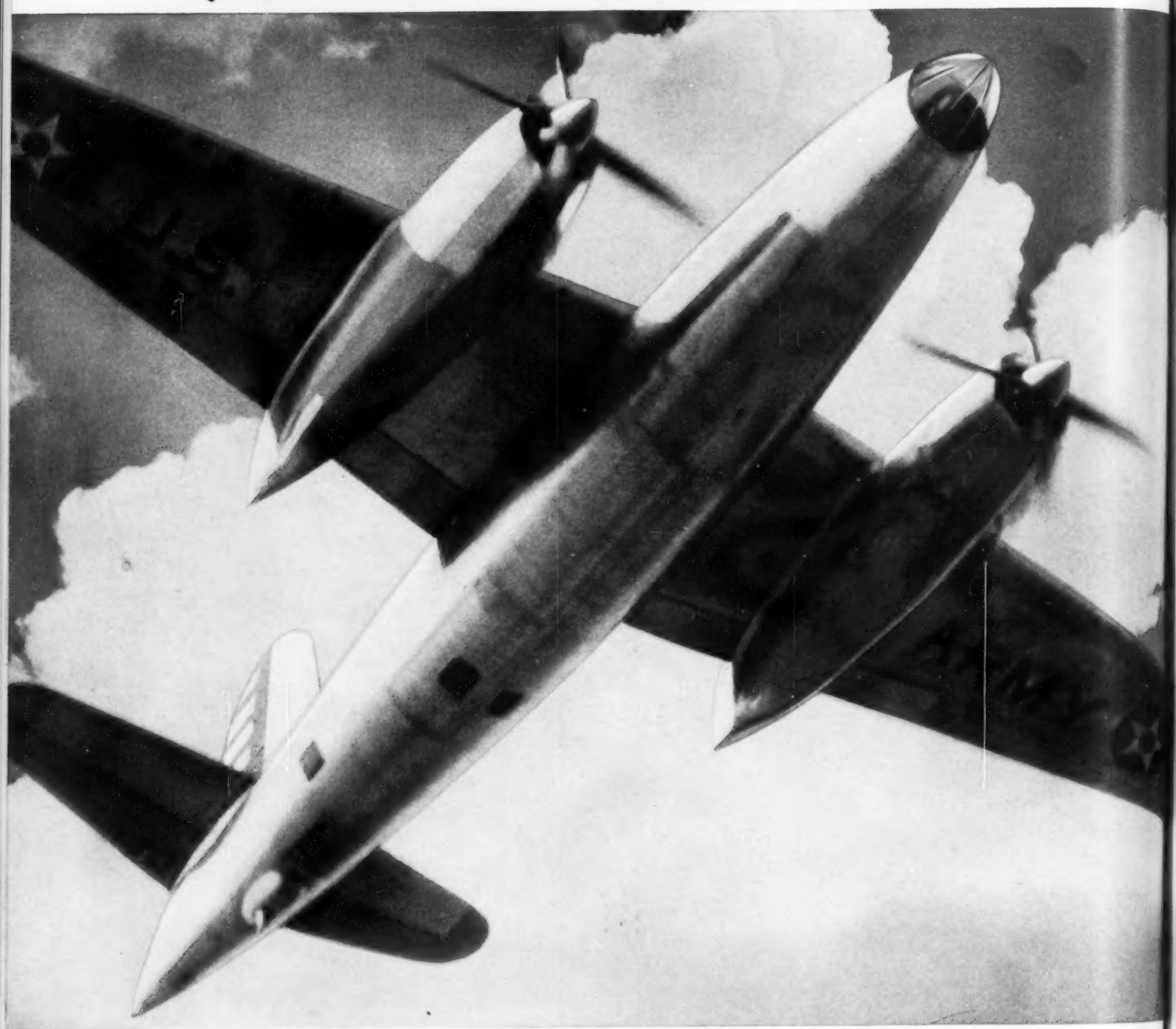
A New MARTIN BOMBER



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Air Power Analysis

NO CLEARER OR MORE thorough analysis of aircraft production in the United States, and the importance of air power to national defense, has been given to the general public than is offered by T. P. Wright, in the January issue of *Aviation*. Placing the air strength of Great Britain at 24,500 airplanes, and that of the United States at 6,000, against a total of 41,000 for the Axis Powers, he indicates that the Democracies cannot surpass the Axis in total air strength until the spring of 1942, but believes that combined American and British monthly production may equal that of the Axis Powers by the middle of 1941.

Mr. Wright points out that a minimum of forty-five different types of military and naval airplanes is required for various war purposes. In addition to this there is the need for frequent changes in new airplanes to keep abreast of new combat tactics in air warfare, and technical improvements. "Each order of combat planes must be large enough to permit efficient production, but not so large as to force obsolete equipment on service squadrons toward the end of the production run." Both of these factors cut production "runs" of military aircraft to a fraction of the mass-production output of automobiles and trucks. Using mass-production methods, there are several automobile companies, each of which has an assembly capacity of 2,000 cars a day. On a 50,000 airplanes-a-year production schedule divided between forty-five different types, plus changes for technical improvements, assembly runs will vary from a few hundred to a few thousand for the entire year. Thus it is shown that mass production of military aircraft simply cannot be compared to that of automobiles or trucks.

Causes of delays in aircraft production in the past months, he attributes both to lack of plan and definite objectives by the Government, and to a natural caution and conservatism on the part of the Aircraft Industry. He stresses the immediate threat to the Western Hemisphere if England is successfully invaded, and the urgency of total national defense. In view of the latter he believes that strikes of Labor and sit-downs of Capital should not be tolerated.

Mr. Wright urges the creation of an independent air force in addition to the present air services required by the Army and Navy. He believes that the time has come when air power should be represented in the executive branch of the Government, by a Secretary of the Air Force who would serve on equal terms with the Secretaries of War and the Navy under a head of all governmental defense agencies. This is not a new proposal, and while it has been debated in the past, Mr. Wright feels that it deserves immediate consideration and action, in the light of developments of the present war.

Private Information

House organs, published for the employees, executives, customers and friends of a particular business organization, usually carry material of little interest outside the company. Often their main function is to maintain social contact between departments. This, however, is not true of most aviation house organs. While they contain the usual personal notes, information of genuine importance to the entire industry frequently makes its first appearance in them. Naturally, news of widespread general interest is announced through the regular channels such as newspapers, trade journals, etc. Further details of such major items and descriptions of less spectacular accomplishments often appear only in company periodicals. Fresh ideas in production, new sales approaches, suggestions for more amicable labor relations, innovations in pattern making, lighting, factory comfort are typical house organ material.

Changes in executive policy, ideas of aviation business leaders are subjects for the daily newspapers. The production expert speaks and the trade publications listen. The scientific journals publish the ideas of research men. In a less scientific and organized manner, the production personnel still does much of aviation's constructive thinking and talking, and the business has not as yet grown old enough to disregard the opinion of even the lowliest apprentice. This production group expresses itself chiefly through company publications.

"House Organs and Catalogues," a department of the Review, was created to study these publications so that all its readers might share the benefits of less publicized reports of technical progress which appear in the house publications of the nation's airlines, factories, schools and other aeronautical organizations.

An Appreciation to Corporate Members of the Institute of the Aeronautical Sciences

Listed below are the leading aeronautical and industrial companies who make possible the publication of the *Journal of the Aeronautical Sciences* through Corporate Membership Dues.

The income from these dues enables the Institute to publish scientific and technical papers in the first section of the Journal without advertising and to devote its pages exclusively to editorial material.

The *Aeronautical Review* is devoted to the dissemination of current aeronautical information of a broader scope and is supported by its advertisers and The Paul Kollsman Library Fund. This library lends aeronautical books and sends them by mail, without charge, to aeronautical specialists in any part of the United States.

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Manual of Modern Maintenance

To aviation's two, three or five foot book shelf of practical working manuals, must be added *Airplane Maintenance*, by Eastern Airlines maintenance engineer, H. G. Lesley. Prepared for maintenance school instruction, and as a reference for air lines, operators, private flyers, and suppliers of parts and materials to the aircraft industry, the book outlines maintenance procedure based upon the sound principles and practices of modern air lines.

In the opening chapter, the evolution of specialized maintenance is traced from yesterday's single mechanic working on a pilot's "personal" airplane, to the swift and thorough overhaul of standardized equipment by crews of specialists of the present. A chart showing the organization of the air line maintenance department is offered together with check-list inspection forms used by Eastern Airlines.

As a thorough understanding of materials and their specifications is so essential to modern aircraft maintenance, nearly a fourth of the volume is devoted to materials and processes. The meaning of material characteristics, and their measure, is explained, and sample specification tables are added to descriptive matter on aircraft metals, plastics, liquids, and other materials. In addition to properties and specifications, the maintenance use of each material is given with suggestions for proper handling and processing. An important division of this section deals with AN (Army, Navy) and AC (Air Corps) Standard Parts, their specifications, and how they are numbered and identified.

There are complete and well developed chapters on controls, maintenance of hydraulic equipment, electrical circuits and equipment, structural repairs, aircraft welding, de-icing equipment, aircraft instruments, fuel and oil systems, heating systems, and a chapter on vibration. The book is marked throughout by careful selection of material and simple clarity in its presentation. It is as up-to-date as a modern air line.

Its usefulness has been well summed up by Major Al Williams, who writes, "Much has been written about aviation and the range has been from the ultra-sensational to the dry technical strata of statistics and measurements. The eminently qualified Mr. H. G. Lesley has drawn upon his experience as a practical maintenance man and aviation expert in compiling this book, which, in my opinion, is a truly remarkable liaison medium for the layman and student. It translates and interprets the highly technical and involved phases of aviation into practical, easy-to-understand language. It is a textbook that makes sense and a narrative which will just suit the taste of the mechanically apt, curious, and ingenious American."

Airplane Maintenance, by Hubert G. Lesley; John Wiley & Sons Inc., New York, 1940; 511 pages, $2.75.

Books reviewed in this section may be purchased, or borrowed without charge, from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, Rockefeller Center, New York, N. Y.

New Edition of a Standard Work

The fourth edition of *The Airplane and Its Engine* is published just four years after the third edition. However, the progress made in aeronautics during this period has led to revision in many parts of the book to incorporate the major advances in the airplane and its engine. Discussion of a number of new developments in both military and commercial aircraft have been added to help give the readers a broad view of the latest developments in aeronautics.

The authors' efforts to bring the book up to date have been notably successful.

The book begins with a chapter which introduces the reader to the nomenclature used in aeronautics. In the subsequent three chapters, the fundamental laws of aerodynamics are discussed with reference to their application to the airplane as an aerodynamic form.

Chapters Six to Ten are devoted to the airplane power plant, with the engine, propeller and auxiliaries taken up separately. The discussion on engines starts with the principles of the internal combustion engine and leads to brief descriptions and illustrations of some of the latest type domestic and foreign aircraft engines. The chapter on propellers includes a discussion of the aerodynamic principles involved in propeller design and a description of the different designs used in propeller construction.

A general discussion of airplane performance is given in Chapter Eleven and a brief description of a number of airplane maneuvers in Chapter Twelve.

Materials and methods used in construction and arrangements of the various structural components of airplanes are discussed in Chapters Thirteen and Fourteen. A brief description with illustrations and performance data on various types of commercial and military airplanes is given in Chapters Fifteen and Sixteen.

The concluding chapter includes descriptions and discussions of the various instruments and accessories used in the modern airplane.

The book is written in such a manner that only elementary technical knowledge is required for its understanding. This fact makes the book very desirable for those who want a broad up-to-date view of aeronautics but who have only a limited background of technical knowledge or training, as well as students in aeronautics.

JESSE H. HALL

National Advisory Committee for Aeronautics

The Airplane and Its Engine, Fourth Edition, by C. H. Chatfield, C. Fayette Taylor and Shatswell Ober; McGraw-Hill Book Company, Inc., 1940; 414 pages, $3.00.

Engine Maintenance

This book is intended to give a general picture of engine maintenance. Special problems peculiar to certain engines are not covered, there being adequate information on such points in engine handbooks prepared by the various manufacturers.

The topics that are covered include a discussion of the general problems of placing the engine in operation, its

maintenance and care, and trouble shooting and repair.

General instructions for engine installation are given with precautions necessary in installing the propeller. Fuels, lubricants and cooling mediums are considered. Starting procedure and precautions, including warm-up period and full throttle run prior to take-off are discussed. Flight operation under conditions of take-off, climb, level flight, economy operation, glide, dive, stunt and inverted flight is covered. Precautions to be observed in stopping the engine are given. The section on engine operation closes with instructions for operation at low temperatures with notes on storage in warm hangars, preheating of oil, and provision of engine covers.

Under engine maintenance, thought is given to subdividing and carrying out a maintenance program with certain operations scheduled at predetermined intervals of flying hours or elapsed time. Instructions for breaking in new and completely overhauled engines are given. Methods of protecting stored engines from corrosion are stated.

A general discussion of symptoms and causes of trouble is followed by specific consideration of starting troubles and troubles encountered in operation. A final topic is procedure to be followed in case of a forced landing.

M. MUNGER
National Advisory Committee for Aeronautics

Der Flugmotor; Teil II; Die Wartung Des Motors, by Gunther Ullsman; Dr. M. Matthiesen & Company, Berlin, 1940; 168 pages, R.M. 3.80.

Men Needed for Aviation

Half a million men must be hired by the aviation industry within the next few months in order to meet the needs of the defense industry, according to a prediction made by Charles S. Mattoon, personnel director of the Curtis Aeroplane Division of the Curtiss-Wright Corporation.

Mr. Mattoon's forecast is made in a survey of the job opportunities and requirements of the aviation industry, published by Air Youth of America.

Finding and training aviation plant personnel, Mr. Mattoon warns, will be the most difficult bottleneck to solve in the national defense program. The present total of somewhat more than 100,000 aviation workers must be increased to 500,000. In addition to the training programs sponsored by the Federal Government through public and private schools, Mr. Mattoon recommends that the larger aircraft companies expand their apprentice training systems.

A warning that automobile mechanics have not been found equipped for aviation mechanic work is contributed to the book by Dr. Robert W. Hambrook, specialist in vocational training of the United States Office of Education.

Dr. Hambrook also outlines a course of study for use in high schools and junior colleges, which includes principles of flight, airplanes and engines, aircraft manufacture, airline operation, as well as ground school subjects such as navigation, meteorology and civil air regulations.

There are special chapters dealing with apprentice training, learning to fly in the U.S. Military and Naval Air Services, and civilian flight training.

Juan T. Trippe, president of the Pan-American Airways, in a foreword to the book states that "today's emergency offers exceptional opportunities" for those who wish to win a place in the aviation industry.

Complete information and an application blank for the Air Youth Scholarships for aviation training are included in the book, together with a list of the approved colleges, Universities and mechanic schools giving aviation courses. The Civil Aeronautics Administration regulations governing pilot and mechanic certificates are also given.

How To Get A Job in Aviation, by Charles S. Mattoon; with a foreword by Juan T. Trippe, and a section by Dr. Robert W. Hambrook; Air Youth of America, 1940; 96 pages, $0.25.

Basic Physical Characteristics of Hydrocarbons Listed

Because of the intensive research in aviation fuels being conducted in many laboratories, Gustav Egloff's compilation, "Physical Characteristics of Hydrocarbons," will be of great value to the field of aviation, as well as to the general chemist. Heretofore, in order to make a survey of hydrocarbon characteristics it has been necessary to consult a large number of authorities, some of whose books and technical papers may not be easily available. This volume collects the essential information together in compact and quickly consulted form.

It opens with methane, and from that simple hydrocarbon proceeds through the more complicated paraffins, olefins and acetylenes, collating existing data upon them as available up to November 1938. The physical characteristics listed are: melting point, boiling point, specific gravity and index of refraction. In some instances additional data are presented. Reference is made to the authority for each figure given. The substances are classified under the general headings of alkanes, alkenes and alkynes, and within those divisions by their carbon skeletons.

The Geneva system of nomenclature was chosen, "due to its simplicity and consistency," it is stated in the introduction, which includes the rules for this method of deriving names, a discussion of data evaluation and limitation and brief remarks upon geometrical isomerism. The compiler is director of research for the University Oil Products Co. The work was undertaken following the meeting in London in 1919 of the Interallied Conference of Pure and Applied Chemistry. This appointed the National Research Council to undertake, with the cooperation of the American Chemical Society, the publication of Critical Tables of Chemical Constants. The present volume is the first to appear.

The book should be considered a "must" for the laboratory or chemist engaged in hydrocarbon research, not only in aviation and other fuels, but also in solvents, rubber, plastics, resins and even pharmaceuticals.

Physical Constants of Hydrocarbons, Vol. 1, Paraffins, Acetylenes and Other Aliphatic Hydrocarbons, Gustav Egloff; Reinhold Publishing Corp., New York, 1939; 403 pages, $9.00.

Official Guide for Model Airplane Contests

Model builders from six to sixty, community youth leaders, and officials seeking a contest guide will welcome this complete and informative book on how to plan and conduct model airplane contests, demonstrations, and exhibitions both indoor and out.

Costs, equipment and materials, sites, and officials and their duties are described and the official rules given for formal meets among experienced contestants.

Games, informal contests, and demonstrations are outlined for newcomers, beginning with gliders and several Air Youth basic models.

An appendix contains among other data a cross-section table, wing-area table, glossary of terms, rules and specifications governing the constructions and flying of model aircraft in contests sanctioned by the N.A.A. through the Academy of Model Aeronautics.

Recommended as a contest guide to all interested in the building and flying of model aircraft.

Model Airplane Contests; Published for Air Youth of America by D. Appleton-Century Company, New York, 1940; 106 pages, $1.25.

A Textbook for the Student Pilot

"Win Your Wings" is published in two volumes, partly because of the breadth of the subject covered, and also to separate the parts dealing with specific information about the private pilot's training course from the parts on advanced flight training and general information about the airplane, its engine and other subjects the successful pilot must be familiar with. The style of the books is friendly and they are easy to understand, for which Colonel Turner is no doubt responsible, as his intimate knowledge of flying makes the presentation a familiar one to him. The co-author, Jean H. Dubuque, an employee of the Civil Aeronautics Authority, contributes his firsthand knowledge of flying regulations to make safe piloting a natural procedure.

Volume 1, inasmuch as it is intended for the use of students in the Civilian Pilots Training Program, closely follows the outline of the Civil Aeronautics Authority's Bulletin No. 21, which was prepared as a textbook for the program. The history of the main events in aviation, accompanied by a chronological list of less important events dating from 232 B.C. to the present, performs the function of an introduction. This is followed by a reprint of the chapter "Theory of Flight and Aircraft" from the Civil Aeronautics Authority Bulletin No. 21. With ground instruction disposed of, flight training methods for the private pilot's license are described next. Excerpts from the Civil Air Regulations are used to acquaint the student with the rules of safe flying. The book concludes with a glossary of about 1,500 aeronautical terms.

Volume 2 starts with a description of advanced flight training and aerobatic maneuvers. To round out the student's knowledge of aircraft, chapters on aircraft instruments, the principles of aircraft engines, specifications of the most recent aircraft engines on the market are given. The chapter "Radio and Instrument Avigation" deals with instrument flying. For the person interested in the details of the corporate structure of airlines and the duties of their departments, the section "Winged Commerce" will be found valuable. In conclusion, a chapter is devoted to suggestions on how to apply for a position in aviation companies, and a description of the Air Corps and Navy training courses for pilots.

Win Your Wings, by Colonel Roscoe Turner and Jean H. Dubuque; Frederick J. Drake and Company, Chicago, 1940; Book I, 649 pages, $3.50, Book II, 426 pages, $3.50.

Revision of a Popular Work

Since Capt. Leyson's "American Wings" first appeared in 1938, there has been great progress in aviation, and therefore it is but natural that now a new edition should be offered, incorporating revisions and additions to bring the work up to date. The latest facts, figures and photographs have been employed.

The book is a popular presentation of military, naval, coast guard, commercial and private aviation, designed for the average reader, and is particularly appealing to the young man who wishes a general survey of the field. That it meets a demand is evidenced by the fact that five printings were required in 1938. It is well illustrated.

American Wings, 1941 Edition, by Captain Burr Leyson; E. P. Dutton & Co., New York, 1940; 215 pages, $2.00.

Jamieson Tells a Story of the Early Days of Night Flying

Now that flying at night is done with the aid of radio beams, few of the public remember that the first night flights were made with few lights, no radio, and a minimum of instruments. "High Frontier" has those early days for its setting, and as elements, a financially stressed airline to which night flying brings needed cash, and a pilot-owner who gets his girl by flying at night.

Leland Jamieson is a commercial pilot, and is also expert at handling the controls of the heart, as is proved once more by this romance that has a double interest due to the manner in which it reveals an interesting page in aviation's history.

High Frontier, by Leland Jamieson; William Morrow & Co., New York, 1940; 309 pages, $2.50.

Official Photograph, U.S. Army Air Corps

Army Air Corps flying cadets inspecting the inside of a fighting airplane as part of their studies in construction, rigging and maintenance. This is an illustration from *Win Your Wings,* by Col. Roscoe Turner and Jean H. Dubuque.

Where to Get Aviation Motion Pictures

Those who organize aviation dinners or meetings of aeronautically minded people often find it difficult to procure a motion picture suitable for such a gathering. Many such pictures are available, some free, others for various amounts. Nearly all purely educational films that are available for general public use are listed in the "Educational Film Catalog" in its revised form.

The Catalog lists only non-theatrical films of all types and is carefully classified, with separate subject and title indexes. It should be clearly understood, however, that there are many non-educational aviation films which naturally would not be found in such a listing of purely educational films. Each film listed is reviewed briefly, and other additional information is supplied, such as length in minutes or number of reels, width of film, sound or silent, etc. The producer and the distributor from whom the film is obtainable are also listed.

Educational Film Catalog, compiled by Dorothy E. Cook and Eva Rahbek-Smith, 2nd; H. W. Wilson Co., New York, 1939; 332 pages, $4.00.

Instruction in Reading Aircraft Blueprints

Students in technical and factory schools giving general mechanical courses found it profitable to use "How to Read Blueprints," which gave an explanation of the most familiar elements and symbols used in engineering drawings, practice as to dimensions, views, scales, and similar basic matters, and then offered instruction in ten special fields of industry, such as cabinetry, structural steel, and so on.

This inclusion of ten fields necessarily limited the attention given to each. This restriction has been lifted from aviation by a special edition entitled "How to Read Aircraft Blueprints." In this, the two sections of the earlier work that dealt with general drafting practice have been almost entirely retained. The rest of the book is devoted to a reproduction and study of typical aircraft blueprints, obtained from various factories. Each blueprint has accompanying it a number of questions for the student to answer. A few prints that are too large to be bound in the book are inserted in a pocket. The work will be useful not only to students, but to executives and others who may need to acquire the ability to read drawings of aircraft and their parts.

How to Read Aircraft Blueprints, by Albert A. Owens and Ben F. Slingluff; The John C. Winston Co., Philadelphia, 1940; 257 pages, $4.00.

Pamphlet Explains Causes and Prevention of Physical Difficulties during Flight

A very useful pamphlet entitled "Medical Guide for Flying Personnel" has been prepared for use of the Canadian Air Force. It was originally translated from the German for the benefit of medical officers, but its medical aspects are not too forbidding or technical, while the comments and advice to the flier are particularly valuable. There is a discussion of gravity, acceleration and centrifugal force in which a few simple algebraic formulae are employed.

The material on the physiological effects of altitude flight and measures to be taken to counteract them should be very helpful. It gives a clear statement about the inhalation of oxygen in a pressure cabin which, as is well known, greatly reduces the development of nitrogen bubbles in the blood by forcing nitrogen out of it, thus minimizing the effects of reduced atmospheric pressure at higher altitudes. The oxygen also makes up for the decreased amount of that vital gas available to the lungs in thin air. Since the pressure cabin and its associated apparatus is heavy and subject to bullet puncture, it is not used in warfare. Instead the oxygen mask is employed to avoid both the "bends" and oxygen starvation. There is a description of the Draeger mask and associated apparatus, with instructions for use.

Other subjects connected with altitude flight that are discussed from a practical standpoint include clothing, protection from exhaust gases, and, for flight at all altitudes, diet, hygiene, air sickness, and sports. The author has some interesting comments on the types of sports suitable for pilots, pointing out that his resistance to the hardships of flight can be materially increased by sports which train the respiration and circulation for enduring activity. Long distance running, mountain climbing, skiing, swimming, and rowing are among those suggested. Mountain sports are particularly recommended on the ground that they accustom the individual to do hard work at the higher altitudes. Boxing and jiu-jitsu are also advised for hardening the body, with the comment that since they are "also excellent methods of self-defense, they develop a calm self-control when one is insulted."

Among the suggestions for actual flight behavior there is the advice to bend over when resisting centrifugal force. It is stated that the limit of centrifugal force that can be borne without the development of symptoms such as the "blackout" is between 3.75 and 5.5 g, and that crouching to lower the head at least four inches produces a gain of resistance of 3 g on a centrifugal force of 9 g, which may be reached or exceeded in high-speed maneuvers.

Medical Guide for Flying Personnel, by Heinz von Diringshofen, translated by Major Velyien E. Henderson; University of Toronto, Ont., 1940; 102 pages, $1.00.

Air vs. Sea Power as Argued by the Washington Conference

At the end of 1918 the naval problem facing the world, according to the authors, "was to fashion some new order of sea power along lines which would head off the impending struggle for control of the seas and at the same time provide that steadying global influence that British sea power alone had formerly provided, but could no longer provide." Military, naval, economic and political factors had contributed largely to this problem, but the thing that had shaken the foundations of naval doctrine and theory was the airplane.

Since the Sprouts' new volume, "Toward a New Order of Sea Power," is essentially a history of navies between 1890 and 1923, the air power *vs.* sea power controversy is not given extended treatment until Chapter 12, pages 213 to 236, inclusive. There it appears as it was seen by those attending the Washington Conference that opened November 12, 1921, to consider disarmament. This chapter gives an excellent, though compact summary of the main arguments of the chief proponents on both sides of the argument, and the views of the nations concerned. As will be remembered, the Conference found no way to limit naval aviation without throttling commercial aviation. In the end, it endeavored to place some restriction on future use of air power over the sea by limiting naval aircraft carriers. Thereby it left for future hostilities to reveal what would happen to a fleet operating off a hostile coast within reach of shore-based aircraft.

The dilemmas faced by the Washington Conference included not only the one of aircraft, which proved practically insoluble, but also those of more purely naval matters, and of national aspirations and policies. The several chapters devoted to this Conference reveal those problems clearly, always without partisanship.

The book is the second of a series, the first having dealt with "The Rise of American Naval Power, 1776–1918," and a third being planned to bring the story up to the present time.

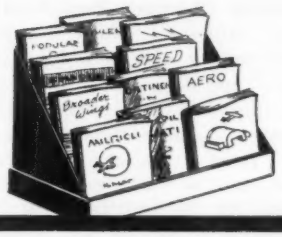
Toward a New Order of Sea Power, by Harold and Margaret Sprout; Princeton University Press, Princeton, N. J., 1940; 332 pages, $3.75.

S.A.E. Handbook Revised

The most important change for the aeronautical engineer in the 1940 edition of this yearly publication is the gathering together into one section all the portions dealing with aeronautical materials. It is now possible to find all the information about them in the first 69 pages of the book, instead of having to refer to general classifications.

Actual revisions in the standard dimensions of aeronautical materials are few. There are, however, two important additions: the table of contents of "Aeronautical Material Specifications" and the table of contents of the "Engine Testing Code" which is being prepared by the Society of Automotive Engineers for the purpose of establishing standard testing methods for aviation engines.

1940 S.A.E. Handbook; Society of Automotive Engineers, Inc., New York, 1940; 834 pages, $2.50 for Members, $5.00 for Non-Members.



Periodicals

The reviews in these pages reflect the statements and opinions of the authors of the articles reviewed, and are not to be taken as editorial expressions of the Aeronautical Review.

Aerodynamics

The Prediction of Performance. Wieslaw Stepniewski. A method of estimating the performance of an airplane which has reached only the early stages of design. It is also useful in estimating the effect of changes on known designs. The article outlines the use of speed polar diagrams to estimate performance of a particular design in level flight, for the determination of its climb, ceiling range, etc. *Aircraft Engineering*, November 1940, pages 329–331, 338, 7 illus.

Recent Work on Airfoil Theory. L. Prandtl. A recent translation by S. Reiss of a report, read before the Fifth International Congress for Applied Mechanics in 1938 on several papers which appeared in Göttingen, dealing with the basic ideas of a new method for treating airfoil problems. A review is given of the problems thus far computed for incompressible and supersonic flow. Test results are given for an airfoil of circular planform. Supplementing this, a theory based on the older methods is presented for rectangular wings of small aspect ratio. *N.A.C.A. Technical Memorandum* No. 962, December 1940.

Which Airfoil? George H. Tweney. Analysis of the Clark Y, N.A.C.A. 6409, and the N.A.C.A. 0012 airfoils for designers of model airplanes. *Air Trails*, February 1941, pages 37, 48, 49, 4 illus.

Some Aspects of Non-Stationary Airfoil Theory and Its Practical Application. William R. Sears. This paper consists of three notes on the theory of two-dimensional thin airfoils in non-uniform motion:

1. In the first note expressions for the lift and moment of an oscillating airfoil are collected from an earlier paper and are presented in convenient forms for practical application.

2. In the second note the lift and moment are calculated for a rigid airfoil passing through a vertical-gust pattern having a sinusoidal distribution of intensity. The lift is determined as a function of the reduced frequency (which in this case is proportional to the ratio of the airfoil chord and the wave length of the gust pattern) and is presented in the form of a vector diagram. It is shown that the lift acts at the quarter-chord point of the airfoil at all times.

3. In the third note the results of 1 and 2 are applied to the calculation of the amplitude of torsional oscillation of a fan blade operating in the wake of a set of pre-rotation vanes. In a numerical example the amplitude is found to be small even when the vanes are spaced so that the exciting frequency coincides with the natural frequency of the fan blade. *Journal of the Aeronautical Sciences*, January 1941, pages 104–108.

Charts for Minimum Turning Radius and Minimum Time of Turn. H. W. Sibert. Two formulas and two charts are given from which the minimum radius and minimum time of turn can be determined for an airplane whose weight alone may take on different values. *Journal of the Aeronautical Sciences*, January 1941, pages 123–124.

The "Plug" Method for Obtaining the Compressive Elastic Properties of Thin-Walled Sections. Howard W. Barlow, Henry S. Stillwell and Ho-Shen Lu. A new method proposed for use in determining the compressive elastic properties of thin-walled sections. The method consists essentially of supporting the section with a cement plug which restrains the flat sides of the specimens from early secondary failure. The method of preparing specimens is simple and inexpensive. Results are given for a large number of compressive stress-strain tests in which the method was used. The results are plotted using a modification of Osgood's non-dimensional system of coordinates. *Journal of the Aeronautical Sciences*, January 1941, pages 109–114.

Airplane Descriptions

Italian Aeroplanes. A description of the Fiat B.R.20 twin-engined mid-wing monoplane bomber, with specifications and performance data. *The Aeroplane*, November 22, 1940, 5 illus.

The World's Largest Bomber. Assembly of the largest military airplane in the world, the Douglas B-19, has finally been completed. Details and problems of construction have been featured for months in many publications. A summary of such data is given in the opening paragraphs of this article, the major part of which is given over to a description of a "dynamic suspension" type engine mounting for its 2,000 hp. engines. Some details of the interior plan are also given. *Aircraft Production*, December 1940, pages 395–398, 10 illus. *The Aeroplane*, November 29, 1940, pages 603–606, 17 illus. *Commercial Aviation*, December 1940, pages 32–34, 7 illus. *Western Flying*, December 1940, pages 18–21, 8 illus.

The 1941 Deluxe Taylorcraft. Description of the new Deluxe Taylorcraft lightplane for the private flyer. The 1941 features include two-color or duo-tone finish inside and out, larger baggage compartment, shock-mounted instrument panel with compartments for radio equipment, side-by-side seating with duo-tone mohair upholstery, and dual control. Construction is basically similar to previous models. Power is supplied by either a 65 hp. Lycoming or a 65 hp. Continental engine. *Aero Digest*, January 1941, pages 85, 91, 4 illus. *Aviation*, January 1941, page 61, 4 illus.

A German General-Purpose Type. A description of the Arado Ar-95, a two-place, general-purpose biplane, used either as a landplane or seaplane. Powered with an 880 hp. B.M.W.132 Dc nine-cylinder, air-cooled, radial engine, it is used as a landplane, for observation and photography and as a torpedo-carrying seaplane. *Aircraft Engineering*, November 1940, pages 325, 326, 338, 9 illus.

A Tricycle Trainer. Complete details and specifications of the "Owlet," a primary trainer which can be used both for blind flying and night flying

training purposes. The Owlet is an all-metal, open cockpit, tandem two seater, of the general construction and design closely patterned after the Cygnet, a popular British lightplane made by the same company. Flight characteristics and training purposes of the Owlet are described, and many of its features shown in a series of photographs. *Flight*, November 28, 1940, pages a–g, 33 illus.

Some More British Aircraft. Drawings and brief descriptions of the Hawker Henley, Avro Anson, Westland Lysander, Bristol Bombay, and the Short Sunderland flying boat. *Aeronautics*, December 1940, pages 48, 49, 5 illus.

London Raider. The Heinkel He.-111K is described. A transparent nose with an off-center "blister" gun position gives the pilot better visibility at a sacrifice of symmetry. Other details include slotted flaps, armored pilot's seat, details of the bomb sight, and some of the flying characteristics of the He.111K. Design and construction are also discussed. *Flight*, November 21, 1940, pages a–c, 8 illus.

The Fiat C.R.42 Single-Seat Fighter. Dimensions and performance of an Italian biplane fighter with high maneuverability and relatively low speed. Squadrons of Fiats are said to be operating from air fields in Belgium. *The Aeroplane*, November 29, 1940, page 598, 5 illus.

The New Fleet Fighter. Description and design background of the Fairey Fulmar. No performance figures or specifications are given. *The Aeroplane*, November 29, 1940, pages 608, 609, 6 illus.

The Ingenious Ju-88. Description of Germany's heavy twin-engined dive bomber. Features shown include anti-flutter "brakes" for control surfaces, automatic "pull-out" as bombs are released, de-icing equipment, self-sealing fuel tanks and structural details. *Flight*, December 5, 1940, pages b–f, 15 illus.

A Captured Fiat B.R.-20 Bomber. Details of equipment, arrangement and armament of the Fiat B.R.-20. Description is not complete because of damage in a forced landing. *The Aeroplane*, December 6, 1940, page 620.

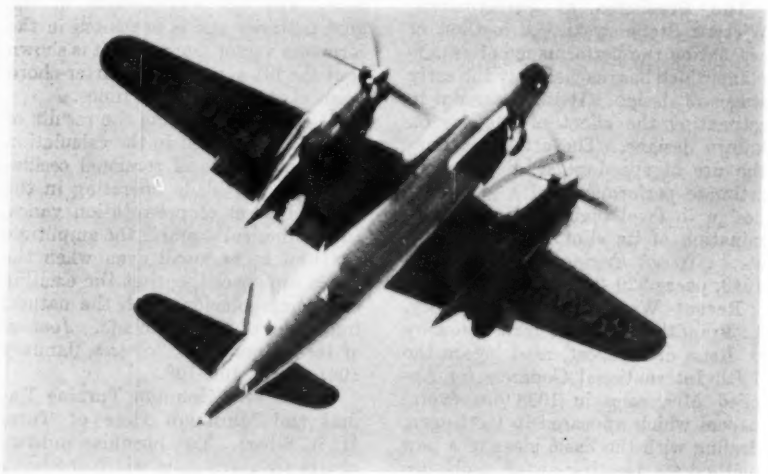
British Aeroplanes on Active Service—1940. Short descriptions and specifications of 83 types of airplanes in the military services of England. *The Aeroplane*, December 6, 1940, pages 641–652, 83 illus.

Sinbad's Modern Mount. Robert McLarren. The history and description of the Blackburn Roc, the British Fleet Air Arm's two-place fighter dive bomber. *Model Airplane News*, January 1941, pages 17, 68, 2 illus.

Geodecstacy. A pilot's description of the Vickers-Armstrong Wellington twin-engined night bomber. The writer, who flew the airplane, describes its flying characteristics. *The Aeroplane*, November 8, 1940, pages 522, 523, 4 illus.

The Ryan ST-3 Trainer. Details of design, construction and performance of the 1941 model all-metal, low-wing, Ryan Trainer, powered by a Kinner radial engine. *Aero Digest*, January 1941, pages 164, 167, 235, 7 illus.

Republic "Lancer" Pursuit-Interceptor. Structural details of a pursuit-interceptor designed for high-altitude operations. It is an all-metal low-wing monoplane, of semi-monocoque construction, powered with a Pratt & Whitney Twin-Wasp engine, rated at 1,200 hp. Provision is made for the installation of four 0.50 cal. and two 0.30 cal. machine guns. Equipment includes the latest type of self-sealing gas tanks and armor plate protection for the pilot. *Aero Digest*, January 1941, pages 168, 236, 2 illus.



An unusual view of the B-26 Medium Bomber, recently completed by The Glenn L. Martin Company.

New Trainer for Air Force. Tentative specifications for a proposed elementary trainer for the R.C.A.F., as released by the Aeronautical Engineering Division of the Department of National Defense for Air. These call for a Menasco or de Havilland powered low or mid-wing monoplane, with a removable transparent top over the cockpits. Of especial interest is that construction of bonded plywood is listed as first preference. The airplane as described would be nearly a composite of the Ryan, Timm and Howard trainers. Other details of design and equipment are listed. *Canadian Aviation*, December 1940, pages 25, 48.

The Vickers-Armstrong Wellington. The Wellington was the first large airplane to use the Wallis system of Geodetic structure. Thoroughly tested in the long range single-engined Vickers Wellesley, the idea of "woven" structure was applied to this large twin-engined night bomber, which has proven itself one of the most valuable types the R.A.F. has at present.

This article is a description of the Wellington twin-engined night bomber; a discussion of its history as well as the advantages of its unorthodox structure. *The Aeroplane*, November 8, 1940, pages 510–516, 7 illus.

Survey of Military Aircraft in the United States. Specifications (except for restricted data) and photographs of 57 types of military and naval aircraft produced in the United States. *Canadian Aviation*, December 1940, pages 29–47, 57 illus.

The Sportsman Test Pilot. James B. Taylor, Jr. The writer flies the Grumman Widgeon amphibian, and describes its equipment and performance. The Widgeon is a five-place twin-engined amphibian, with a top speed of 160 m.p.h. Other details of flight characteristics, equipment and cost are given. *The Sportsman Pilot*, December 15, 1940, pages 12, 13, 30, 3 illus.

Air Policy

The Truth About Our National Defense. T. P. Wright. An engineer's appraisal of the present status of our National Defense by an outstanding aircraft manufacturing executive and a consultant to the National Defense Advisory Commission. It explains why aircraft production has lagged thus far and indicates how much it is actually behind. Presented in the clear, methodical manner of the scientist, the article first states the basic fact which has created the problem of National Defense: proof that Democracy is being menaced. Next he defines the psychological and material fundamentals of defense which must prevail if this Democracy is to meet total aggression with total defense.

This is followed by a discussion of defense procedure, indicating the need for an Independent Air Force and a Department of National Defense, to be created without disturbing existing agencies. In outlining the current problems of aircraft production, Mr. Wright states that the number of aircraft types being produced which is about fifty at present, could not be reduced below 40 or 35 without damaging military efficiency of the air forces. Producing more airplanes in the shortest possible time requires increased floor space, labor, machinery and intelligent management. Suggestions on how these components of increased production can be procured and managed for adequate production of superior designs in aircraft are made.

The program for the building of 50,000 airplanes annually, first announced by President Roosevelt last May was, according to the writer, held up by failure to define its objectives, interference between government agencies charged with doing the same job, by faulty organization in the hastily formed Defense Advisory Commission, by delays in Congress on necessary legislation and by the conservatism of industry. The article discusses the efforts in increased production already made, indicates past errors and outlines the proposed production program with the object of eliminating future mistakes by examining carefully those which have already been made. *Aviation*, January 1941, pages 30–33, 130, 132, 134–136, 138, 22 illus.

What About the CPTP? George E. Haddaway. A plea to continue the Civilian Pilot Training Program beyond July 1, 1941, when present funds will expire. Objections to various phases of the program are answered by citing results to date. Among the latter are 2,600 new cadets for the Army and Navy, 700 flight training centers giving the standard training course, many of which are being used by the Army for its own cadets, refresher instruction and rerating of hundreds of civilian flight instructors, increased production of training airplanes and the number of airfields available for training purposes. *Southern Flight*, December 1940, pages 8, 9, 17, 1 illus.

Canada Has a Beaverbrook—Without the Power! Percy T. Cole. A discussion of the problem of aircraft production in Canada. It is stated that Government interference, red tape and the withholding of authority from the present Director General of Aircraft Production are chief causes of present delay. Other problems are said to be delay caused by amendments to specifications, cumbersome customs regulations on American imports and customs bookkeeping on aircraft sent to England. It is believed that Ralph P. Bell, Canada's production chief, could do much to eliminate red tape and delay, if only he were given the power to do so. *Commercial Aviation*, December 1940.

The Army Co-op. Command. Major F. A. de V. Robertson. Discussion of how far the Air Ministry should go in releasing control of air squadrons for special Army operations. It is stated that the Air Ministry has feared dissolution, and for that reason has tried to retain control over all aircraft. The writer believes that such fears are now groundless and that military efficiency demands that the Army be given complete control over certain types of aircraft for special military duties. *Flight*, November 28, 1940, page 449.

More History in the Making—II. C. G. Grey. The question of British losses, both of leaders in key positions and R.A.F. personnel in training, through airplane accidents, is cited for attention and preventative action. The deaths of Air Vice-Marshal Charles Blount, and the Australian Air Minister, J. V. Fairbairn, as well as the R.A.F. lists of casualties "on active service," are offered to support a suggestion for a drive against preventable accidents. *The Aeroplane*, November 29, 1940, page 610.

Half of Everything. Leonard Engel. A survey of American airplanes in production for Great Britain. Rate of production, number of aircraft on order and some performance figures are given. A bottleneck is said to have developed in the production of Allison engines which has held up both production of Curtiss P-40s or Tomahawks as the British model is called, and the Bell Airacobra. Other aircraft mentioned include Grumman, Brewster and Lockheed fighters, and Boeing, Douglas and Consolidated bombers. *Flight*, December 5, 1940, pages 472–474, 11 illus.

Matters of Moment. A plea to give private enterprise a freer hand in the design and development of military aircraft for Great Britain. It is shown that much of England's superiority of design was due to "desperation in the men of ideas" who went ahead and built experimental aircraft without waiting for government approval. Another business man who didn't wait for official decision, was F. S. Spriggs, Chairman of the Hawker-Siddeley Co. Ltd., who tooled for Hurricane production at a rate "which at the time, would have horrified the Air Ministry." As a result, most of the "thin red line" of fighters which broke up the German mass attacks by air, were Hurricanes. Production of Spitfires was still being built up. It is strongly recommended that certain private aircraft firms be allowed to build and demonstrate experimental models, instead of having to get blueprints approved and releases of materials, labor and factory space, from the Air Ministry. It is believed that such a policy will save time, improve design, and speed development of better military aircraft. *The Aeroplane*, December 6, 1940, pages 617, 618.

Air Defense—1941 Style. Carl Dreher. Analysis and forecast of air defense requirements for the United States. The writer states that the first line of defense against aerial attack is the U.S. Navy Air Arm, which he says, is not only one of the finest, but the largest in the world. The importance of long range bombers to the defense of the United States is emphasized, and it is said that bomber production will be built up long before our two-ocean fleet can be ready. Training problems of the Army and Navy air forces are described, and the opinion expressed that graduates of the Civilian Pilot Training Program accepted for training, will make good military pilot material. Suggestions for the improvement of the air defense program include (a) more time and money for research, (b) more discussion of air defense, (c) take the public into the Government's confidence, to a greater extent, (d) eliminate the two-year college requirement for flying cadets. *Popular Science*, February 1941, pages 72–80, 7 illus.

Aerial Observations. A discussion of the importance of private flying to military aviation and national defense. Written as a reply to rumors that private flying is to be curtailed due to defense considerations, the article

stresses the value of the CPTP to national defense and suggests expansion, not contraction of civilian private flying. *The Sportsman Pilot*, December 15, 1940, pages 5–9, 5 illus.

Our Designs on Martinique. Frank Gervasi. Description of Martinique as it is today. Stagnating as a colony cut off from its mother country, it is stated that the island itself would be a distinct liability. However, the U.S. Navy could use its harbor as a base to fill a gap in our defenses between Puerto Rico and Trinidad. Navy men say that the harbor is one of the best for both ships and flying boats. French naval vessels and the general defenses of Martinique are discussed. The writer also examined the American aircraft, of which he says there are not 110, but six Brewster and 59 Curtiss fighters, or a total of 65. Contrary to report, he found them carefully tended and in excellent condition. The American warship patrol off Martinique is also described. *Collier's*, January 11, 1941, pages 14, 15, 41–43, 4 illus.

A Republican View of Air Defense. Senator Robert A. Taft. The writer indicates his belief that one of the duties of the Republican minority in Senate is to see that plans on air defense proposed to Congress, yield a maximum return in National security for every dollar spent. *National Aeronautics*, December 1940, page 11, 2 illus.

Our Status in the War. Cy Caldwell. An analysis of the reasons why the writer believes that the United States must make it possible for England to continue the war, regardless of immediate risk. He states that British numerical inferiority in airplanes and airplane production is far more serious than they can afford to admit, for reasons of morale. He believes that Germany must and will make the supreme effort to invade England, and that the United States must help England, and help her now, with what we have. *Aero Digest*, January 1941, pages 40–42, 5 illus.

Aviation's Lesson From France. Report of an address by Arthur Nutt, of the Wright Aeronautical Corporation, before a meeting of the Society of Automotive Engineers in Toronto on November 19th. Analyzing the production decline and failure of the French aircraft industry, the speaker discussed several factors which he believed were among the chief causes. Included were (1) severe profit limitations and penalties on contracts; (2) fifty per cent of the nation's toolmakers taken by draft, and not released, (3) labor difficulties, (4) nationalized factories less efficient than those of private industry, (5) fifth column activities, (6) official corruption, (7) lack of planning and coordination, (8) lack of proper engineering standards, (9) factories exposed to continuous enemy bombing. The importance of England and the United States avoiding these mistakes was emphasized. *Canadian Aviation*, December 1940, pages 28, 48, 1 illus.

Air Power and the United States Army. Major General H. H. Arnold, the newly appointed Deputy Chief of Staff of the U.S. Army, emphasizes two points. First, that air power has come into its own. Second, that the United States is building an air force commensurate with its interests, rights and responsibilities. The history of the Army Air Corps from its infancy at Fort Meyers in 1908 up to the present day is outlined. General Arnold also stresses air power's present and future importance as an equal partner with Land and Sea Power in National Defense. *National Aeronautics*, December 1940, pages 7–9, 6 illus.

Airports

Airport in the Blue. Edward S. Marshall. The Municipal Airport at Roanoke, Va., operated on a deficit for many years. It is now showing a profit. How a persevering airport manager, Robert J. Dunahoe, accomplished this, is described. It also contains an outline of Dunahoe's career in aviation. *Flying and Popular Aviation*, January 1941, pages 21, 58, 60, 62, 2 illus.

Aerial Floorshow. David Leigh. An account of the writer's visit of LaGuardia Field, New York's Municipal Airport. The article contains a description of the hangars, waiting rooms, ramp and terminals, as well as the traffic control system, the maintenance and schooling for pilots and other personnel which takes place here. *Airlanes*, December 1940, pages 4, 5, 19, 8 illus.

Flygfalt (Flying Field). Discussion of the layout and ground organization of military flying fields. Obstructions should be as few as possible, and well marked, in order to increase the efficiency and safety of the air force. *Flygning*, No. 21, November 1940, pages 26, 27.

Chicago Municipal Airport. Elimination of a railroad track, and the completion of paved dual runways this spring, will make the Chicago Municipal Airport one of the outstanding municipal fields in the country. Details of the project are given. *Aero Digest*, January 1941, page 44, 2 illus.

Air Transport

"Eyes Aloft" Charles A. Rheinstrom. Description of the preparation which precedes the take-off of a transport airplane, and an outline of the work which has gone into those few minutes which have elapsed between the time the passenger arrives at the terminal and the airplane leaves the ground. *National Aeronautics*, December 1940, pages 12, 13, 5 illus.

Emancipation Day for Aviation. Gill Robb Wilson. A prediction of the important part that air freight will play in the future of air transportation. The effects that large scale transportation of merchandise by air may have on airports, research and the entire aviation industry are outlined. *National Aeronautics*, December 1940, page 17.

Sky-High Freight. Kurt Rand. An account of the freight carrying operations of the Condor Air Lines, which flies machinery, supplies and other heavy objects to remote places in the Peruvian Andes. *Flying and Popular Aviation*, January 1941, pages 36–38, 88, 6 illus.

Airline South of South. Major Arturo Meneses. The establishment of regular air service carrying mail and passengers to Punta Arenas on the Strait of Magellen was a difficult and dangerous mission. Once accomplished, it allowed this southernmost settlement in the world to grow to a good sized municipality, due to the regularity with which passengers and mail arrived. This article is an account of the pioneer work done by members of the Chilean Army Air Force in 1929, in opening the air route over the rough terrain between Aysen and Punta Arenas. *Flying and Popular Aviation*, January 1941, pages 44–46, 8 illus.

Yesterday's Speed Record—Today's Schedule. Raymond Daniell. Details of the recent record breaking flight of a Lockheed Lodestar transport from Burbank, California, to Jacksonville, Fla. *Southern Flight*, December 1940, page 10, 1 illus.

High Sierra Airways. Albert M. Latimer. An account of the establishment of air service between Lone Pine, California, and several airfields high in the Sierras, which serve several hunting and fishing camps during the season. Its operators are two young men whose idea that business men would rather go by air than make a twelve-hour journey by horseback up the mountain trails, has proven to be correct. Included is a description of equipment and landing fields. One of the latter is at an altitude of 9,250 feet. *Western Flying*, December 1940, pages 30–32, 4 illus.

Armament

Student Gun Designer. Russell Peters. Armament design is offered as an elective subject, in advanced aeronautical engineering training, by Aero Industries Technical Institute, Los Angeles. The writer, who is a student taking this course, describes some of the assignment projects, and the design problems involved. *Air Trails*, February 1941, pages 15, 58, 59, 4 illus.

High Explosive Bombs. B. Brady. The purposes, construction and functioning of high explosive bombs. Included are details of the bomb release mechanism. *Aeronautics*, December 1940, pages 36, 37, 2 illus.

Guns Per Bomb. It is stated that the German practice early in the war of sacrificing armament and armor in their bombers for speed, has proven costly. How and where armor has been added by the Germans in their attempts to decrease the vulnerability of their bombing aircraft to the eight-gun British fighters, is shown. Details of armor and armament of several types of German military aircraft are discussed. *Flight*, November 14, 1940, pages a–f, 15 illus.

Biography

Controls, Unlimited. Nicholas N. Plasterer. The life story of Charles A. Ahrens, builder of the Ahrens remote controls for aircraft. The article also contains a description of the Ahrens controls, outlines their functions, and enumerates some of the well known companies which use them. *Flying and Popular Aviation*, January 1941, pages 18–20, 66, 6 illus.

Jack Northrop Begins Again. James Bassett. Biographical sketch of John K. Northrop, together with details of some of the famous airplanes he has designed. Included are a few "rumors" about a new Northrop airplane undergoing tests by the U.S. Army. *Air Trails*, February 1941, pages 18, 46, 47, 5 illus.

Proficient Professor. George E. Jones. An article containing a biography of Frederick K. Kirsten, Professor of Aeronautical Engineering at the University of Washington. It also explains the principles of the cycloidal propellers, a development on which the professor has been working for a number of years. *Flying and Popular Aviation*, January 1941, pages 39, 68, 2 illus.

Patriarch. Pascal Cowan. An account of the aviation career of E. Hamilton Lee, the oldest pilot in the country from the standpoint of hours flown. After almost 22,000 hours in the air, "Ham" Lee still maintains that a pilot must be an aeronautical engineer to keep up with the times. *Flying and Popular Aviation*, January 1941, pages 43, 72, 2 illus.

Major "Reub" Fleet. One-page biography of Major Reuben Hollis Fleet, president and general manager of Consolidated Aircraft Corp. *Western Flying*, December 1940, page 29, 1 illus.

Bill Stout. Description of the work of W. B. Stout, who states that the second coming of aviation is at hand. His aviation activities at present are concentrated on a new design for a private plane, known as Skycar II, made of spot-welded stainless steel, with a 90-hp. engine, and a two-speed gearshift for the propeller by which its r.p.m. is increased to 3,600 for the take-off. It is a high-wing monoplane, with engine and propeller in the rear, landing flaps, and inter-connection of rudder and ailerons to prevent spins. Stout claims that anyone can learn to fly it in two hours. Making five planes a day, they will cost in the neighborhood of $2,200 each. Mass-production could lower the price to about $1,000, he thinks. Gross weight, 1,310 lbs.; span, 35 ft.; length, 20 ft.; aspect ratio, 10.8; wing load, 11.5; speed, 110 m.p.h. *Fortune*, January 1941, pages 46–51, 108, 110, 18 illus.

Business and Finance

M-Day and the Aviation Industry. Leigh Wade, a pilot on the Round-the-World flight by the Army in 1924, who has since been engaged in commercial aviation in South America, examines the effect of wartime production on exports to South America. He believes that due to speed-up of airplane manufacture for military purposes in case of war, exports of commercial aircraft would have to be discontinued to South America. *U.S. Air Services*, December 1940, page 17.

Plan New Trainer for R.C.A.F.—This Procedure Followed. Purchasing information for prospective suppliers of a new trainer for the R.C.A.F. (see "New Trainer for Air Force" under Airplane Description). The Training Division of the R.C.A.F. under Air Commodore Robert Leckie, Air Member for Air Training, will purchase the new trainers. Other officials in charge of specifications, testing and supply are listed. *Canadian Aviation*, December 1940, page 26, 3 illus.

Design

The Long-Range Bomber. Noel Pemberton-Billing. Suggested design and specifications for a bomber which would carry five tons of bombs five thousand miles at 400 m.p.h. Powered with two engines of 2,000 each, it would have a wing loading of 98 lbs. per square foot, which would be reduced to 32 lbs. per square foot for the take-off by a method of assisted take-off. Maximum speed, fully loaded at 20,000 ft. on 4,000 hp. is figured at 435 m.p.h., rising to 460 m.p.h. after reaching its objective, as fuel is consumed. Cruising speed of 400 m.p.h. at 20,000 ft. would require 3,100 hp. with full load, 2,750 hp. after 2,500 miles, 2,500 hp. after bombs are dropped, and 2,340 hp. at the end of the return trip. Span is given as 61 ft., length 40 ft., gross wing area 420 sq. ft., power loading 10 lb./hp., wing loading at landing 38 lb. per sq. ft., stalling speed fully loaded 130 m.p.h., stalling speed for landing, 82 m.p.h. The bomber would carry a crew of three in a small pilot compartment forward. The rest of the fuselage would be given over to fuel and bombs. *Flight*, November 14, 1940, pages 413–415, 2 illus.

Midget Military Aeroplanes. W. O. Manning. Suggested specifications for fighters and bombers less than half the size of present British types. Advantages for the fighter are said to be maneuverability, less cost and faster production, and for the bomber, all these plus speed. *Aeronautics*, December 1940, pages 62–66, 2 illus.

To Those Whom it May Concern. Noel Pemberton-Billing. The writer presents his idea for assisted take-off of a high-speed, long-range bomber. The bomber, designed to carry five tons of bombs for 5,000 miles at 400 m.p.h., would carry a second airplane on its back to provide the extra wing area needed for take-off. The two components would be so designed that when joined they would become a biplane with the necessary lift and rate of climb, at a much lower speed. Once the desired altitude is reached they would separate, and the so-called "slip-wing" or upper component would return to the base. A summary of experiments in assisted take-off is given together with points in favor of the "slip-wing" system. *Flight*, November 21, 1940, pages 429–432, 3 illus.

Hydraulic Servo Mechanisms. Laurence Pomeroy. A discussion of the use of hydraulic rams for the motivation of retractable landing gear, bomb doors and flaps. The advantages of this type of design are compared with those of electrical installations. Lockheed hydraulic undercarriages, typical two-way hydraulic mechanisms are described and illustrated. *The Aeroplane*, November 22, 1940, pages 577–580, 8 illus.

Basic Points of Successful Military Aircraft Design. The writer believes that basic points of similarity of design in successful airplanes can be scientifically formulated as a measure of performance qualities. These "octane ratings" of performance qualities would be used for purposes of comparison and guidance in design and development. *Aeronautics*, December 1940, pages 46, 47, 2 illus.

Control Surface Mechanisms. Raoul J. Hoffman. A description and explanation of the methods used in motivating airplane controls. *Flying and Popular Aviation*, January 1941, pages 55, 78, 1 illus.

Flygplans Prestanda. (Airplane Performance.) Erik Raab. Following a study of the characteristics of the various types of military airplanes, difficulties of judging an airplane during the acceptance test are discussed. *Flygning*, No. 21, November 1940, pages 14, 15.

Aero Engine Shapes. A. C. Clinton. Study of aircraft engine shapes relative to aircraft design. *Aeronautics*, December 1940, pages 44, 45, 5 illus.

The Development of Design. A description of the changes in design of the Vickers-Armstrong Wellington twin-engined night bomber since the prototype was first produced in 1936. *The Aeroplane*, November 8, 1940, 516–521, 24 illus.

Analyzing the Requirements of Supercharged Cabins. David Gregg. Discussion of supercharger outputs at various altitudes and r.p.m. necessary to maintain fresh air and pressure requirements for supercharged cabins at high altitudes. Problems of design and of non-standardized specifications are described. *Aero Digest*, January 1941, pages, 136, 139, 140, 143, 6 illus.

How Fast the Fighter? Peyton Autry. An analysis of potential fighter speeds based on reasonable limits of power loading, wing loading and lift coefficient. *Aero Digest*, January 1941, pages 132, 235, 3 illus.

Engines

Surface Hardening of Engine Parts by the Nitriding Process. Description of the nitriding process used at Wright Aeronautical Corp. It is accomplished by circulating ammonia gas over the surfaces of parts made of Nitralloy steel, at a temperature of 1,000°F. Nitrogen liberated from the ammonia by the heat, reacts chemically with the metal to form an unusually hard, corrosion and wear resisting surface. Production at Wright is said to be 2,500 nitrided cylinder barrels every three days. *Aero Digest*, January 1941, pages 114, 235, 4 illus.

Aero-Engines. Extract from a paper by F. Munzinger. Discussion of the possibilities of steam-powered aircraft engines. It is said that in the future, steam turbines may well be considered for aircraft power units of 2,000–3,000 hp. and up. Problems of design are outlined, and it is stated that these are largely confined to weight reduction of steam generators and condensers. Weight/power ratios of steam were three times as great at the close of the world war as they are today, and it is believed that 1.1 to 1.65 lbs. per hp. for large steam plants can be developed. *Steam Car Developments and Steam Aviation*, August-September 1940, pages 289–294.

The C.U.E. Cooperative Universal Engine for Aviation Single-Cylinder Research. A. W. Pope. A description of the C.U.E. engine built for research on full size aircraft cylinders under controlled conditions. *S.A.E. Journal*, January 1941, pages 33–40, 10 illus.

No Steam Engines for Aircraft. The case against steam power for airplanes. It is stated that the problem of making a steam condenser suitable for aircraft, plus a thirty percent greater fuel weight per horsepower hour, will probably make steam power out of the question for some time to come. *Aeronautics*, December 1940, page 91, 1 illus.

Overhead conveyors loading cylinder barrels into new nitriding furnaces at the Wright Aeronautical Corporation's plant at Paterson, N. J.

Forty-Eight Ordinate Harmonic Analysis and the Harmonic Spectrum of Two-Cycle Diesel Torque. Nancy Klock. A presentation and explanation of the 48-Ordinate Fournier harmonic analysis of periodic curves. A harmonic spectrum of two-cycle Diesel torque which would be required for the analysis of torsional vibrations is given, the writer believes, for the first time. *Journal of Applied Mechanics*, December 1940, pages A158–160.

Franklin 6-Cylinder Engine. Carl T. Doman. An account of the design and development of the new Franklin 6-cylinder, horizontally opposed engine. Available in two sizes, 264 cu. in. and 298 cu. in., developing 120 hp. at 2,600 r.p.m. and 130 hp. at 2,550 r.p.m., respectively, the engine is said to have been built to operate at considerably higher speed with the idea of being geared to attain increased outputs. A power curve shows that the larger size develops 164 hp. at 3,500 r.p.m., indicating the reserve power which can be had when the gear train is made available. Other details of equipment, construction and performance are described. *Aero Digest*, January 1941, pages 148, 151, 152, 231, 10 illus.

The Jumo 205 and 207. Descriptions of the Junkers Jumo 205-E 700 hp. and the Jumo 207 one thousand hp. Diesel engines. *Aviation*, January 1941, pages 63, 106, 1 illus.

The D. V. L. Hub Dynamometer. E. Gilbert and W. Ulrich. A description of the D. V. L. hub type dynamometer for determining the power output of an engine while in flight. Results are recorded by a "film scratching" method. *Aircraft Engineering*, November 1940, pages 327, 328, 4 illus.

Die graphische Ermittlung von Ausstroemvorgaengen. (Graphic Determination of Exhaust Phenomena.) O. Lutz. Various problems of engine construction required the determination of the course of exhaust phenomena. This determination is made difficult by the fact that besides external variables, such as variation of the exhaust section during operation, variation of the volume of the cylinder, variation of pressure, etc., the variation of the thermal value of the exhaust gas has to be taken into consideration. If the process is to be approximately determined, without going into exhaustive details, a solution may be expected only by the application of the "i-s" representation. This report gives the solution by means of a differential equation, using the Lutz and Wolf "i-s" table. *Luftfahrtforschung*, October 26, 1940, pages 332–335.

Anti-Friction Bearings for Rod Ends. The use of ball bearings in flight and engine controls, for precision of control, is described. *Aeronautics*, December 1940, page 92, 2 illus.

An Instrument for Continuous Measurement of Piston Temperatures. Arthur F. Underwood and A. A. Catlin. A description of the instruments and method by which the temperature of a moving piston could be determined. This article also contains tests data on the temperature gradients of both aluminum and cast iron pistons and the effects of load variation and advance on piston temperature. *S.A.E. Journal*, January 1941, pages 20–27, 19 illus.

Wear Resistant Coatings of Diesel Cylinders. J. E. Jackson. A study of the influence of chemical surfacing in the running-in of Diesel cylinder liners. Because it is difficult to lubricate the bore liner during this period, scratching or scuffing often results. This may be largely eliminated through the use of a caustic-sulfur treatment for the liners before assembly. *S.A.E. Journal*, January 1941, pages 28–32, 17 illus.

Factory Equipment

A Universal Welder. Description of the Metropolitan-Vickers model ASP welding machine. A heavy duty machine for welding all commercial ferrous and non-ferrous metals, with the exception of light alloys, it can be used either for spot or projection welding. Details of construction and control are given. *Aircraft Production*, December 1940, page 381, 1 illus.

The Inspection of Machine Tools. Summary of a discussion on the desirability of standard acceptance charts. Last spring the British Institution of Production Engineers and the Institution of Mechanical Engineers jointly published Part 1 of the *Acceptance Test Charts for Machine Tools*, prepared by the research department of the former Institution. The charts have been the center of much controversy regarding their desirability and value. Points for and against are offered in this report of a discussion by members of both Institutions. *Aircraft Production*, December 1940, page 382.

Flexible Electrical Distribution Aids in Aircraft Assembly. Louis F. Kummel. Description of underfloor electrical power ducts for aircraft assembly plants. *Aero Digest*, January 1941, pages 163, 232, 3 illus.

Magnaflux Inspection. W. E. Thomas. Details of new and improved equipment for Magnaflux inspection of metal parts and welds for hidden flaws. *Aero Digest*, January 1941, pages 135, 211, 6 illus.

Meeting Machine Tool Requirements of the Aircraft Industry. Tell Berna. Survey of the expansion of the machine tool industry, with an estimate of the output for 1941. It is shown that growth in machine tool production has roughly paralleled that of airplane production. Increased power and performance of modern machine tools is described. *Aero Digest*, January 1941, pages 106, 109, 10 illus.

Gliding and Soaring

An Introduction to Soaring. Robert M. Stanley. A treatise on soaring, presented by the writer to the National Aeronautics Council, is reprinted serially. In this, the first installment, the general history of gliding from da Vinci to Lilienthal and Chanute is outlined. *Soaring*, October-November 1940, page 8.

From Pinfeathers to Wings. Alexis Dawydoff. Instruction suggestions and sequence for beginners in gliding. Students first learn to handle controls on the ground with the glider pointed into the wind. Then comes control practice while being "taxied" or towed behind a car, and short low-altitude flights and landings. From there the student progresses to air work and finally soaring. *Air Trails*, February 1941, pages 22, 51, 53, 5 illus.

The Philosophy of Gliding and Soaring. D. G. Manges. An explanation of the manner in which soaring types of birds are propelled. According to the writer, they derive propelling energy from rising and horizontal currents of air and from centripetal air pressure produced in spiralling, or when flying in a circular direction. The manner in which all three of these forces operate is outlined. *Soaring*, October-November 1940, page 7.

Sun Valley Soaring. Lewin Barringer. The log of almost three weeks of soaring in Sun Valley, Idaho, by a group of experts and their friends. This spot, well known to skiers, has proved to be just as promising as soaring terrain. *Soaring*, October-November 1940, pages 4–7, 4 illus.

The Sargent Winch. John Wölbast. The description of a winch for launching gliders, designed by the late Herbert Sargent, Jr., built by the Hudson Valley Glider Club. *Soaring*, October-November 1940, pages 3, 14, 1 illus.

History

Famous Firsts in Aviation. Freeman Cleaves. A brief outline of the early history of aviation from the time of Leonardo da Vinci to the first Wright Brothers' flight at Kitty Hawk. A list of important "firsts," such as the first officially recorded flight by the Wright Brothers, almost two years after Kitty Hawk, is also given. *Air Youth Horizons*, pages 1, 4, 1 illus.

Flying, as It Was—. Col. Harold E. Hartney. Experiences of the writer in the 1919 Transcontinental Reliability Race. Held under the auspices of the War Department and the American Flying Club, the race called for a round-trip between New York and San Francisco. On October 8, 64 airplanes took off, 49 from Mineola and the remainder from San Francisco. Best elapsed time was made by Lieut. Belvin W. Maynard, who covered the distance in 9 days, 4 hours and 26 minutes. The article is an official report to the War Department, first published in the *Air Service News Letter* on November 7, 1919. *The Sportsman Pilot*, December 15, 1940, pages 18, 19, 31, 32, 6 illus.

High Altitude Flying

Pressurized Cabin Control. H. E. W. Tinker and H. S. Hubbard. A description of the pressurizing equipment for high altitude passenger aircraft built by the Airesearch Mfg. Co. and the method of its operation. The article also outlines the physical effects of high altitude flying on passengers and pilots. *Aviation*, January 1941, pages 38, 119, 124, 4 illus.

Instruction

A Daredevil Grows Up. Boone T. Guyton. After learning to fly fighting airplanes in the Navy, the writer went to work for an airline. This article is an account of what happened during the transformation of a Navy pilot,

schooled to daring, into an airline co-pilot, whose first consideration is the safety of his passengers. *National Aeronautics*, December 1940, pages 22, 23, 3 illus.

Night Flight. A. J. Parra. A Randolph Field cadet describes his reaction to his first flight at night. *National Aeronautics*, December 1940, pages 30, 44.

Flight Instruction Under Control. George R. Reiss. Survey of the effect of the standardization of instruction by the C.A.B. The writer finds that almost invariably, students who have been taught by a CPTP rerated instructor learned more rapidly and thoroughly than those who had taken haphazard, uncontrolled flying instruction. The article also contains a simplified outline of the standardized CPTP flying course as contained in C.A.B. Bulletin No. 5. *Flying and Popular Aviation*, January 1940, pages 26–28, 83–85, 5 illus.

Solo from the Start. John R. Hoyt. An account of experiments in primary "flight" instruction in a Link Trainer. It is stated that some pre-instruction time in a Link Trainer not only helps a student gain the coordination he needs to become a successful pilot, but can tell him in advance whether or not he shows promise as a flyer. The article contains figures on the accuracy with which the Link Trainer made such predictions. *Flying and Popular Aviation*, January 1941, pages 30, 31, 74, 76, 78, 4 illus.

Johnny Get Your Lathe. Louis Eisman. A survey of the educational opportunities in skilled trades which the defense program is making available to young men in aviation and other industries. Government agencies and private sources of this training are listed and discussed. *Future*, November 1940, pages 10–12, 3 illus.

The Men Behind No. 1 Air Observers School. Percy Cole. History of Dominion Skyways, and its subsidiary, Dominion Skyways (Training) Limited, which is Canada's first school for air observers. Graduates of the latter are now in action with the R.A.F. *Commercial Aviation*, December 1940, pages 52, 54, 56, 58, 7 illus.

Flying Cadets Wanted. Lieut. Frank Kurtz. An officer member of a traveling Air Corps examining board debunks the "superman aura" surrounding physical and mental qualifications for the Army Air Corps Cadet. Normal sight, hearing, equilibrium and general physical condition are required. It is stated that the general misbelief about physical perfection is a carryover from the old days when flying was supposed to require superhuman effort and ability, and unnecessary ballyhoo was given physical qualifications. Opportunities in Air Corps training are also given. *Western Flying*, December 1940, pages 22, 23, 34, 4 illus.

Personnel—The Real Bottleneck in the Aircraft Defense Program. Herbert C. Mayer. Discussion of personnel and personnel procurement problems of the aircraft industry. Sources of supply, problems of selection and training are outlined and suggestions made for increasing the flow of skilled labor into the aircraft industry. *U.S. Air Services*, December 1940, pages 14–16, 36, 1 illus.

Winter Operation Hints from Experience in the North. Proper procedure for starting and warming up engines, take-off, climbing, cruising, and landing airplanes under conditions of extreme cold. *Canadian Aviation*, December 1940, pages 24, 53, 2 illus.

Aviation Courses—Federally Aided. Robert W. Hambrook, U.S. Office of Education, Washington, D.C. A pamphlet outlining requirements of subject matter, length of courses, and number of hours for full and part-time courses in aviation, necessary to qualify for Federal Aid. Schools which received Government help in 1939, are listed together with aviation courses offered in each. *U.S. Office of Education, Misc. 2295*, 16 pages.

Aeronautics Courses in Colleges and Universities. Robert W. Hambrook, U.S. Office of Education, Washington, D.C. List of colleges and universities which offer courses in aeronautics, including those which offer curricula in aeronautical engineering approved by the Engineers' Council for Professional Development (1939). The pamphlet also contains a discussion of the work and training of an aeronautical engineer. *U.S. Office of Education, Misc. 2177*, 6 pages.

Fly It Yourself. Richard Thruelsen. An account of the writer's first flight in the Ercoupe. Safety and control simplicity are described, especially his unsuccessful attempts to put it into a spin. "Foolproof" take-off, landing and flight characteristics are emphasized and described in detail. *Saturday Evening Post*, December 21, 1940, pages 20, 51, 52, 3 illus.

Down-Wind vs. Up-Wind Turns. Richard R. Bloss. Mathematical calculations of additional altitude necessary when flying up-wind, to equalize potential energy of up-wind with down-wind flight, of a given airplane, with power off. For example, it is shown from a graph that to successfully negotiate a down-wind turn, an airplane with an airspeed of 100 m.p.h. in a 30-mile wind, would require 400 ft. more altitude than it would to make an up-wind turn at the same airspeed and wind velocity. A simple formula, for computing problems involving airspeed, wind velocity, and altitude required, is given. *Aero Digest*, January 1941, pages 155, 232, 3 illus.

Instruments

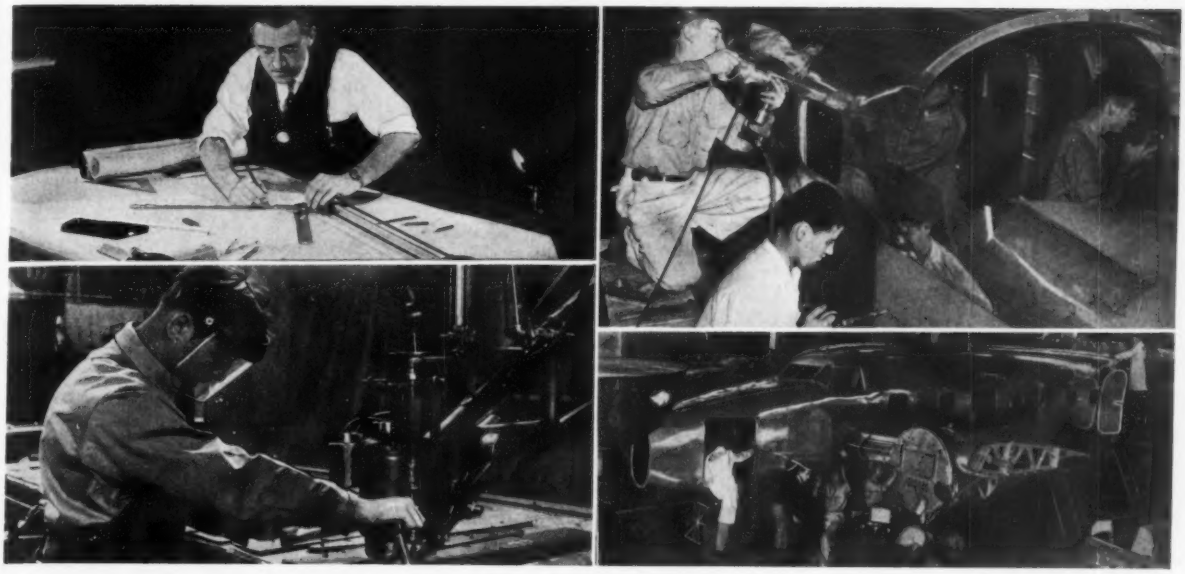
Vliegtuig-Instrumenten. (Airplane Instruments.) J. W. Verhoeven. First of a series of articles describing functions, purposes and uses of airplane instruments. General requirements of airplane instruments are discussed. These include: (1) Steady indication—no vibrations due to poor installation. Proper suspension may be obtained by means of sponge rubber. (2) As not all the instruments can be placed directly in front of the pilot, there should be a minimum of parallax for those which he has to read from an angle. (3) A practical scale division. (4) Graduation easily readable both day and night. (5) Instruments should be balanced to eliminate faulty indication due to acceleration. (6) There should be no possibility of mixed indications. (7) Normal sensitiveness to fluctuations of atmospheric pressure and temperature, with the exception of instruments which indicate fluctuations. (8) Elastic after-effect must be as little as possible. (9) Instruments should be able to withstand excessive loads. Miscellaneous secondary requirements such as small dimensions, sufficient sensitiveness, and minimum friction are also discussed. *Luchtvaart*, November 19, 1940, pages 422–425.

Instrument Flying

Some American Blind Approach Systems. Description of several systems of instrument approach systems being tried in the United States. Included are the Bendix system, the A. T. & T. system, and a system undergoing tests by the U.S. Navy at Lakehurst. *Aeronautics*, December 1940, pages 40, 41, 2 illus.

"On Instruments." Series of pictures of flight instruments as they appear during various basic maneuvers. *Air Trails*, February 1941, pages 20, 21, 21 illus.

Standardized Let-Down Procedure. Allan A. Barrie. A description of the Barrie Instrument Approach Guide and directions for its use. This pocket instrument, designed by the writer who is a captain on Western Air Express, works like a slide rule. Its purpose is to simplify let-down procedure for pilots flying on instruments by means of a standardized method suitable to all airplanes and airplane ranges. *Aviation*, January 1941, pages 39, 124, 2 illus.



Four steps in the building of an airplane at the Lockheed Aircraft Corporation's factory. Upper left, an engineer at work on the design of a new airplane. Below, a power-driven router, cutting out metal parts. Upper right, riveters at work on a sub-assembly. Lower right, the airplane, nearing completion on the final assembly line.

Law

Quarterly Review of Decisions—Aeronautics. A review of legal decisions pertaining to aeronautics. Included are reviews of several cases involving life insurance claims, and one in which the C.A.A. attached a borrowed airplane when the pilot was found operating without a license. *Air Law Review*, October-December 1940, pages 424–442.

Legislative and Administrative Activities—Aeronautics. Legal discussion of recent decisions of the Civil Aeronautics Authority defining standards for certificates of public convenience and necessity. Also included is a check list of pending aeronautical legislation. *Air Law Review*, October-December 1940, pages 405–410.

To Sue or Not to Sue. Solomon Rothfield. The second in a series on the legal aspects of airport operation. This article deals with the court decisions affecting the building of obstructions near airports in order to hamper flying. The new C.A.A. legislation enacted last year to control the height of new buildings near airports and airways is cited and explained. *Aviation*, January 1941, pages 36, 37, 126, 4 illus.

Maintenance

Two-Day Turnaround. Maintenance routine for servicing the transatlantic Clippers. The huge flying boats are taken from the water to the hangar, where every detail of equipment and structure is carefully examined and checked. It is stated that as many as 1,500 separate jobs may be performed during the two days the aircraft is serviced between trips. Details of equipment and servicing methods, are shown and described. *Popular Science*, pages 92–95, 16 illus.

Honing Engine Parts. Lawrence S. Martz. A description of the methods and equipment used in reconditioning cylinder barrels, connecting rods and other engine parts by the use of micromatic honing tools. *Aviation*, January 1941, pages 56, 57, 126, 7 illus.

Simplifying Airplane Maintenance. F. Peter Hirsch. Description of an improved type of self-sealing coupling installed in the fire wall of an airplane. It permits the disconnection of all liquid-carrying pipe lines without the loss of fluid or the inclusion of air. In the exchange of power plants, this coupling would eliminate the necessity for draining and recharging pipe lines. *Aviation*, January 1941, page 69, 3 illus.

Manufacture

The Airspeed Oxford—Part III. Parts I and II of this series described the manufacture of the center section, tail unit and wings. Part III deals with the fuselage assembly, fabrication of flaps and ailerons, engine mounting, and final assembly. Further examples of the extensive use of the sub-assembly principle, are shown. Production of cabin enclosures by a sub-contractor, is described in detail. Fabrication of metal sub-assembly units is also given, together with the sequence followed in final assembly, and the installation of engines and equipment. *Aircraft Production*, December 1940, pages 383–391, 29 illus.

The Jigging of Modern Airframes. The second installment in a review of the building of jigs for aircraft production. This installment describes methods of jigging fuselages of various types in England and other countries. The writer divides fuselage structures into three classes: stressed skin, girder and unconventional. The methods of jigging examples of each type are shown. *Aircraft Engineering*, November 1940, 339–346, 39 illus.

Factory Lighting in War-Time. A study of factory illumination for greater efficiency, applying the figures collected by the British Departmental Committee on the lighting of factories. The use of mercury vapor, fluorescent and incandescent electric lighting as well as combinations of artificial lighting and daylight, as applied to various jobs in aircraft plants, is discussed. *Aircraft Engineering*, November 1940, pages 347, 348, 3 illus.

The British Aircraft Industry—1940. A pictorial review of British aircraft. While censorship does not permit either the customary directory of manufacturing companies or details of latest designs, present types are shown, with a brief description of the work they do. *The Aeroplane*, December 6, 1940, pages 632a–640, 8 pages illus.

Ground Form Finishing Hobs. Charles R. Straub. A study of the manufacture and care of hobs. This

article shows the differences in manufacture and application, between machine-relieved and relief-ground hobs, placing emphasis on the relief-ground type recommended for use for gears where silent running, uniformity of rotation and close fitting are required. Instruments used in testing the accuracy of the hob are also described. *S.A.E. Journal*, January 1941, pages 10–19. 22 illus.

29,600 Parts Make One Bomber. Series of color photographs with captions describing the fabrication and assembly of a Boeing four-engined bomber. *Saturday Evening Post*, December 28, 1940, pages 18, 19, 57, 15 illus.

A Plane Is Born. Quentin Reynolds. An American reporter visits an English aircraft factory and describes assembly line production methods by which a Hawker Hurricane is completed every two hours. It is stated that the same plant turned out a new experimental fighter, from blueprints to test flight in sixty-three days. American machine tools, parts, and aircraft engines were found in this factory, and much emphasis is given the high morale and team spirit of its personnel. *Collier's*, December 21, 1940, pages 21, 22, 1 illus.

The German Weser "Shadow" Plant. The history of the Weser Flugzeugwerke, one of the largest of the "shadow factories" engaged in aircraft construction. At present, this plant, which was constructed at Delmenhorst, is believed to be producing Junkers Ju.87b dive bombers. *The Aeroplane*, November 15, 1940, page 548, 2 illus.

Novel Assembly Methods Used for Boeing A-314. Description of improvements being made in new Clippers for Pan American Airways. Jigging and assembly methods are shown and described. *Aero Digest*, January 1941, page 160, 6 illus.

Applying Automotive Methods to Aircraft Production. Don. R. Berlin and Peter F. Rossmann. The first in a series of articles on the application of mass production principles, used in the automotive industry, to large scale airplane manufacture. Introductory in nature, it explains the basic principles of mass production, showing similarities and differences in the basic problems of motor car and airplane construction. *Aviation*, January 1941, pages 42, 43, 122, 144, 7 illus.

The Use of Rubber for Producing Sheet Metal Parts. (Part II.) Chris J. Frey and Stanley S. Kogut. Further examples of hydraulic press work, with rubber used in place of male or female dies. It is stated that many aircraft manufacturers are not deriving full use of newer production techniques, now available. An example is cited of one company in which 200 out of 1,700 men employed still do hand forming, while at the Douglas Aircraft Co., only 8 out of 20,000 are consigned to hand operations. It is further revealed that all of Douglas' rubber hydraulic press work is accomplished on one 2,000-ton capacity press, working full time. The production of many parts is shown, and problems of blanking, forming and shearing, are discussed. *Aero Digest*, January 1941, pages 116–118, 121, 235, 20 illus.

Recent Developments in Metal Extrusion. Albert B. Cudebec. Survey of methods developed during the past five years, for the production of stainless-steel, nickel-alloy, bearing steel, tubing, shapes and rods. The extrusion process, presses, dies and tools, and problems such as surface oxidation and scrap losses, are discussed. *Mechanical Engineering*, January 1941, pages 16–18, 2 illus.

Machine Scheduling. C. W. S. Parsons. Small machine shops, engaged in aircraft work, have developed special problems in scheduling machine loading and routing production. Due to unusual conditions produced by defense orders, and to the irregular needs of aircraft builders, demands on estimators and supervisors, have been greatly multiplied. This article outlines a method for scheduling, and control of machine loading, for aircraft sub-contractors. *Aviation*, January 1941, pages 50, 51, 104, 106, 2 illus.

Warplane Factories in Germany. Paul H. Wilkinson. The third in a series about aircraft in Germany. This article describes the Jumo Diesel engine plant at Dessau. Production methods used for the Jumo 205 are described. The writer indicates that tooling up for Diesel production is no more difficult than it would be for gasoline engines. *Aviation*, January 1941, pages 48, 49, 3 illus.

Production at Noorduyn. A picture survey of the production facilities at the Noorduyn Aviation Ltd. plant near Montreal, Canada. At present, this factory is engaged in building the Noorduyn Norseman and the North American Harvard trainer for the R.C.A.F. *Aviation*, January 1941, pages 40, 41, 11 illus.

Development of a Plastic Moulded Airplane. Harold P. Moon. A discussion of the development of plastics in aircraft. The two types of synthetic plastic, thermosetting plastics and thermoplastics are described, and the advantages of thermoplastics as an adhesive in aircraft construction are outlined. The "Vidal Process" developed by the Aircraft Research Corporation applies the use of a thermoplastic to the construction of wood airplanes. Using this method, plasticized sheets of wood veneer which have been placed over properly contoured wooden forms may be moulded under heat and fluid pressure into a single, homogeneous, reinforced structure. Also given is a description of the Summit HM-5, a two-place low wing monoplane, powered by a Continental A-75 engine, built of this wood and plastic material by the Vidal Process. *Aviation*, January 1941, pages 44, 45, 140, 144, 9 illus.

Materials

Use of Cork in Aircraft. Specifications for cork products in aircraft are given together with details of processing raw cork into laminated sheets or blocks. The manufacture of gaskets is also described. *Aircraft Production*, December 1940, pages 379–381, 10 illus.

Steel-Cutting Carbide Tipped Tools. Philip M. McKenna. Performance data on a recently developed tool composition containing a non-cratering, long-wearing compound of tungsten-titanium carbide designated $WTiC_2$. Tools tipped with this ingredient are finding wide use in aircraft engine machining operations. Data from Rolls-Royce showed fifty pieces per grind on an operation for which the former average was fifteen, and a cutting time cycle reduced from 10 minutes to 5 minutes 53 seconds. Details of other tests and performance runs are described. *Aero Digest*, January 1941, pages 110, 112, 7 illus.

Fluxes for Soft Soldering. Discussion of uses and special applications of various types of fluxes in soldering. The function of fluxes in soldering is described, together with the results of tests comparing flux activity. *Aircraft Production*, December 1940, pages 393, 394, 1 illus.

Protection of Magnesium Metals. Outline of processes used to prevent corrosion under service conditions. The problem is one of insuring complete adherence of paint to the surface, and various treatments to this end are described. Results of corrosion tests are given in several tables. *Aircraft Production*, December 1940, pages 408–411, 8 tables.

Faults in Light-Metal Castings. F. Bollenrath and E. Schiedt. Stresses at different points on light metal castings show a wide variation, and knowledge of their distribution is only approximate. The accuracy of stress figures on aluminum and magnesium alloy castings are frequently disturbed by the presence of casting faults. This article is a report of observations on the influence of such faults on the

strength of light metal castings. It shows the results of examinations made during acceptance tests and during machining of such parts as engine bearer rings, undercarriage knee-joints, spokes of hand wheels, angle brackets, etc. *Aircraft Engineering*, November 1940, pages 332–335, 338, 14 illus.

Stainless Steel as an All-Round Aircraft Metal. Description of the properties of 18–8 stainless steel and its adaptability to widespread use in aircraft manufacture. It is stated that a new process of heat treating cold-rolled stainless steel at relatively low temperature has improved its elastic properties. Fabrication of stainless steel by means of spot welding, is also discussed and a comparison drawn between spot welding and riveting for strength, production speed and cost. Automatic welding machines which make 1,000 welds per minute, are described. *Commercial Aviation*, December 1940, pages 38–40, 7 illus.

Laminated Plastics for Aircraft Parts. S. W. Place. Discussion of the properties, processing, uses and fabrication of laminated phenolic plastics. Suggestions are given as to the most satisfactory methods of threading, milling, drilling, sawing and punching. Also included is a chart showing characteristics of various grades. *Aero Digest*, January 1941, pages 122, 125, 128, 131, 9 illus.

Aluminium het Metal van Nu. (**Aluminum the Metal of the Hour.**) A review of the part aluminum plays in the present war. At the beginning of the war France was the largest producer of bauxite, and England was largely dependent on French production. Since the defeat of France, England has had to look elsewhere for this mineral. It is available from British and Dutch New Guinea and Guyana, and should these sources run out, from British India which has enormous, unexploited bauxite deposits. There is also the rapidly developing Canadian aluminum industry which is able to supply a great part of the aluminum which England requires. Supplies are also available in Ireland and the United States. In addition, England has collected all old aluminum pots and pans, to be used in her war industry. Discussing the widespread use of aluminum in war production, it is stated that 90 percent of modern war equipment contains aluminum or one of its many alloys. *Luchtvaart*, October 22, 1940, pages 382, 383.

Materials Testing

X-Ray Finds Flaws in Aircraft Parts. The method of locating flaws in stressed metal parts of aircraft is described by one of the scientists who developed the X-ray inspection system used by the Lockheed Aircraft Corporation. The article outlines the development of X-ray inspection technique from its inception five years ago up to the present. How the capacity of X-ray machines was developed from 100 parts per day to 5,000, is described together with present methods of recording, numbering, X-raying and inspecting of parts. The spectrographic method of inspection, as an auxiliary to the X-ray at the Lockheed plant is also shown. *Aviation*, January 1941, pages 46, 47, 108, 5 illus.

Medicine

Structural and Other Precautions Against Air Raid Risks in Hospitals. Dr. William Henry Walsh. Basic list of precautionary measures to be taken for both existing hospitals, and in the planning of new construction. Sandbagging, protection against flying glass of windows, partitions, and the glass-enclosed operating theater, protection of roofs against the penetration of incendiary bombs, basement shelters and trenches, decontamination of gas casualties and emergency lighting facilities, are discussed. Other suggestions are made for the location, layout and construction of new buildings. *The Military Surgeon*, December 1940, pages 517–525.

Medical and Sanitary Care of the Civilian Population Necessitated by Attacks from Hostile Aircraft. Captain Lucius W. Johnson, Medical Corps, U.S. Navy. Detailed summary of measures of sanitary and medical protection for civilians under bombing attack. The war in Spain, in China, and present bombing operations of the Germans over England, are used as examples of what total war means to civilian populations in terms of air attack. The problem of civilian air defense is stated, and the British Air Raid Precaution activities and organization described. A plan for American communities is given, together with a discussion of types and treatment of civilian casualties. *The Military Surgeon*, January 1941, pages 1–24, 5 illus.

Luftfartmedicinens Grunder (V). (**Problems of Aviation Medicine.**) E. V. Nystrom. In the previous chapters the reaction of the human organs to altitude has been outlined in detail. The writer discusses adaptation to altitude, altitude effect and altitude tolerances. It is stated that altitudes from 2,000 to 3,000 meters mark the limit of reactions (indifferent zone), from 4,000 to 5,000 meters the limit of safety (zone of compensated altitude effect), from 6,000 to 8,000 meters the critical limit (zone of non-compensated altitude effect). Above this altitude is the zone of altitude death. *Flygning*, No. 20B, October 1940, pages 14–15, 22.

Meteorology

Another Case Where Weather Is Important. Report of an attempt by the Germans to establish a weather station in Greenland. Since Germany occupied Denmark, weather reports from Iceland have been denied German meteorologists, hence the Greenland venture which was forestalled by a Norwegian patrol boat. It is stated that much of Germany's weather information to the west, and in the lower latitudes, comes from weather broadcasts by the U.S. Naval station at Arlington, Va. *U.S. Air Services*, December 1940, page 9.

Light Changes in Clear Sky Permits Prediction of Clouds. A simple instrument has been invented by Dr. Hans Neuberger of the Pennsylvania State College with which the formation of clouds in a clear sky can be predicted several hours before they appear. The instrument utilizes the fact that the light from most of a really clear sky is polarized. Before a cloud appears, there is a sudden increase in moisture condensation about particles in the air, such as dust, combustion products and tiny crystals of ocean salt. When these particles are present in large numbers, there is no polarization. The instrument is used to measure sky polarization, detecting the swelling of these condensation particles, thus predicting cloud formations. *Science News Letter*, December 7, 1940, page 358, 1 illus.

Nagot om Isbildning pa Flygplan. (**Data on Ice Formation on Airplanes.**) Tage Svensson. A study of conditions which cause ice formation, and of theories on this subject developed during the last decade. *Flygning*, No. 20B, October 1940, pages I–V.

On the Origin of Depressions in Southern China. C. S. Yao. An analysis of the formation of cyclones along the lower Yangtse. It has been found that most of these develop in the Lake-Basin region between 20 deg. N. latitude and the Yangtse. The action of Pc air masses from Siberia and warm air masses from the Gulf of Tonkin and the south are described. *Bulletin American Meteorological Society*, November 1940, pages 351–355, 2 illus.

A Study of Meteorological and Physical Factors Affecting the Formation of Ice on Airplanes. J. K. Lacey. Under physical factors, the writer derives a theoretical relation between the number of cloud droplets per unit volume, the prevailing drop size, and the amount of ice deposited per unit

cross-section area of the collecting object. In the second part, a statistical relation is established between the stability of cloud layers and the occurrence of ice formation. From an analysis of selected surface charts and vertical cross sections, certain rules are formulated to aid the air line forecaster in the preparation of ice warnings. *Bulletin American Meteorological Society*, November 1940, pages 357–367, 9 illus.

An Important Cause of General Precipitation. H. L. Choate. It is suggested that widespread precipitation may be the result of convective cooling of air strata through upwelling of currents of relatively small cross section. Examples are cited to support this belief. *Bulletin American Meteorological Society*, November 1940, pages 369–377, 8 illus.

Notes on Rapid Airplane—Sounding. William H. Wenstrom. Details of a plan for mounting a streamlined case containing a thermometer and hygrometer outside the fuselage of an airplane so that readings at 500-ft. intervals can be read back over the radio transmitter. Airplane sounding of levels up to 10,000 feet are suggested for military and airline use, as well as for regular weather stations. *Bulletin American Meteorological Society*, November 1940, pages 385, 386.

The Hazards of Icing. Capt. Fred Smith. Suggestions for avoiding the hazards of icing. The pilot is cautioned against generalizations in forecasts of icing conditions, and warned not to fly in any kind of icing weather without de-icing equipment. The writer advises against risking flight in icing weather, regardless of equipment, and offers a number of helpful suggestions of how to minimize hazards, if icing conditions are encountered unexpectedly. *Aero Digest*, January 1941, page 43.

Detection of Supercooled Fog Droplets. Ronald L. Ives. Supercooled fog droplets may be detected, in many instances, by means of a modified polariscope, used in conjunction with a source of sonic disturbances. Possible application of these findings to the problem of detecting incipient aircraft wing-icing is suggested. *Journal of the Aeronautical Sciences*, January 1941, pages 120–122.

Recent Fog Investigations. Dr. Sverre Petterssen. Wright Brothers Lecture, delivered before the Institute of the Aeronautical Sciences, at Columbia University, December 17th. The first part of the paper is devoted to the physics of fog, and a discussion of the meteorological conditions under which various types of fog may form. Included is a study of condensation, different types of air-borne nuclei of condensation, and the wide variance in their powers to attract moisture. Properties, characteristics and sizes of various nuclei are described, together with the condensation process and factors which control the colloidal stability of fog.

The problem of dissipating fog by artificial means above limited areas such as an airport runway, is outlined, and several methods described, which have thus far proven impractical.

The second part of the paper, concerning the meteorological conditions during the forming of fog, describes conditions necessary for the forming of frontal fogs, steam fog or Arctic Sea Smoke, as well as those governing the formation of the more commonly observed radiation, advection, and upslope fogs. The behavior of fog over snow-covered ground was also treated, and a classification of fog producing and fog dissipating processes offered in summary. *The Journal of the Aeronautical Sciences*, January 1941, pages 91–103, 12 illus.

Military Aviation

Japan is Not an Air Power. Leonard Engel. A survey of Japan's air power, giving a description of the structure of its Army and Navy Air Force. The equipment of both air forces, their personnel and training methods and the distribution of their equipment and men are discussed. The writer indicates certain weaknesses in the air forces which he believes has kept Japan from becoming an important air power. *Flying and Popular Aviation*, January 1941, pages 12–24, 70, 8 illus.

Fixed Guns vs. Free. Robert A. Winston. The problems confronting a bombing airplane, armed with free guns, being attacked by a single seater fighter armed with fixed machine guns, are discussed. The writer gives the loss of 700 twin-engined Russian bombers in Finland as an example of the superiority of fixed armament. *Flying and Popular Aviation*, January 1940, pages 16, 17, 79, 80, 3 illus.

Three Dimension War. James L. H. Peck. The introduction of the airplane as an important factor in modern warfare has, in the opinion of this writer, altered the basic concepts of military operations. War has become a three-dimensional conflict, and war "fronts" have given way to war areas. Control of the air over the affected areas has become one of the first concerns of the men who plan battles. Superiority in aircraft type and number has, in many cases, been the factor that decided victory or defeat. This article is a review of the events which have made many military authorities alter their positions on the importance of airplanes in the present conflict. *Flying and Popular Aviation*, January 1941, pages 32–34, 66, 5 illus.

Rebirth of an Air Force. At their new Canadian training camp known as "Little Norway," the Royal Norwegian Army Air Force is training pilots to continue their war against Germany. Its cadets are being drawn from all over the world, many of them from Norwegian ships which were unable to return to Norway. Training with the latest American equipment, they "say little and do much" toward the day when they will be able to put into the air more than the original five squadrons which were scattered by the overwhelming German air superiority. Experiences of several pilots during the invasion and subsequent fighting in the north, are described. *Commercial Aviation*, December 1940, pages 25–28, 7 illus.

Norwegians Use Mobile Airports. Remembering the experience of having its airfields bombed out of existence while it fought in the air, the Norwegian Air Force, training in Canada, has equipped itself with three Couse Mobile Airports. The unit consists of a special truck, carrying service tools, overhaul and welding equipment, generator, flood lights, two-way radio, and a steel and canvas shelter for personnel. Mobile airport units were developed by K. W. Couse from special repair trucks which he had built for highway contractors operating in remote sections of the United States. It is stated that they have been tested under war conditions and found practicable. *Commercial Aviation*, December 1940.

Military Reporting. Military intelligence reporters piece together valuable bits of information from a close study of enemy newspapers and periodicals. Advertisements in the Help Wanted columns reveal new plants, or new activities of established factories. Social items show the whereabouts of important officials or military units. Financial statements sometimes betray plant capacities. Examples of military reporting with samples of military information revealed, are listed, and the work and its requirements described. *Aeronautics*, December 1940, pages 32–43, 3 illus.

Air Fighting Tactics. Tactical methods of air combat which have developed in the present war. Pilots and aircraft of England and Germany are also compared. *Aeronautics*, December 1940, page 50.

The Extended Application of Air Power. W. A. B. Further possible and probable uses of aircraft in war are discussed. Some of them, such as the tank- and cannon-carrying airplane, have been tried successfully.

Others include tank-carrying gliders, the use of large freight-carrying airplanes to prevent total blockade, possible uses of the helicopter, and new uses for the torpedo-carrying airplane. *Aeronautics*, December 1940, pages 96–98, 5 illus.

Canada, Democracy at War. Frank Gervasi. By spring, Canada hopes to be able to provide England with 650 pilots and 300 airplanes a month. Progress toward this objective is outlined in this description of the Empire Training Program in Canada. The problems met by Lord Riverdale of England and Prime Minister Mackenzie King of Canada before the training and airplane production program got under way are discussed. The importance of Canada's "bush" pilots to the R.C.A.F. training program is also indicated. *Collier's*, December 28, 1940, pages 19, 38, 3 illus.

Heroes in Glass Houses. James L. H. Peck. One of the most dangerous, exacting and tiring assignments in aerial warfare, according to this writer, is that of the gunner in the modern bombing or two-place fighting airplane. Seated in a cramped, uncomfortable station, his job has, this far, proven three times as dangerous as that of the pilot, as he sits in the exposed sections of the airplane with his guns as only defense interposed between himself and the enemy. This article is a description of the gunner's job and a discussion of his problems in modern warfare, as well as a history of this position, which came into being during World War number one. *Scientific American*, January 1941, pages 12–14, 3 illus.

Air Transport for Invasion. O. L. L. Fitzwilliams. The use of gliders as troop and material transports in wartime was suggested and experimented with, during peacetime. England, according to this writer, did some primary experimental work along these lines, as did Russia and Germany. It is held as a distinct although unconventional possibility that Germany might attempt to invade England using trains of gliders towed by airplanes. The technique of mass take-off of the glider trains, their formation and defense is discussed. The writer states that invasion of England without the use of tanks by troops alone would be almost impossible. The baby tanks which have been experimentally carried in airplanes are of such light weight and inferior design that they would be of little use. The idea of carrying a regular field tank in a towed glider is presented, outlining the changes in the regulation tanks which would have to be incorporated. *The Aeroplane*, November 15, 1940, pages 552–555, 5 illus.

Production of the Curtiss Tomahawk, built for the R.A.F., has been increased to eight airplanes a day at the Curtiss Aeroplane Division of the Curtiss-Wright Corporation, Buffalo, N. Y. Part of the final assembly department is shown above.

A Fighter's First Flight. Brain Sparks. Non-technical account of the first test flight of a new single seater fighter. The flight terminated with the accidental release of self-inflating flotation bags on each wing at 200 m.p.h. Resulting vibration and flutter became critical until successive skidding turns, first right, then left, tore the bags loose. This maneuver snapped steel cables built to withstand 3,000 pounds strain, which held the bags in place. *The Sportsman Pilot*, December 15, 1940, pages 10, 11, 32, 33, 35.

Pacific Northwest Tightens Defense. Survey of military and naval air defense projects in the states of Washington and Oregon. It is stated that activity in this area includes the adding of facilities to McCord Field, a naval air station at Sands Point, near Seattle, as well as expansion of civil air fields for potential military use. Details of new highways and airport improvements at Seattle and Bellingham, are also given. *U.S. Air Services*, December 1940, pages 31, 32.

Know Your Warplanes by their Insignia. Jesse Davidson. A history and description of the markings of the military aircraft of Great Britain, Germany, Italy, Japan, China, Russia, Finland, Norway, Belgium, France, Poland, Rumania, Turkey, Greece, Egypt, Bulgaria, Sweden, Holland, Switzerland, Ireland, Mexico, Czechoslovakia and the United States. *Model Airplane News*, January 1941, pages 8–12, 47, 49, 26 illus.

Fifteen Miles of Hangars. Last summer 80,000 lineal feet of wooden hangars 112 feet wide were erected for the R.C.A.F. Their timber construction was made possible by "timber connectors" which have raised the working strength of timber joints from an average of 50–67 percent to 80–120 percent of the strength of members connected. It is stated that costs were lowered by timber construction, and a fire test is described to support the claim that fire hazard with a sprinkler-equipped wooden hangar is considered not excessive. *Commercial Aviation*, December 1940, pages 41, 44, 50, 7 illus.

Gevechten in den donkeren Nacht. (Night Air Attacks.) A discussion of British air defense. Special attention is now being given to weather forecasting, wind and temperature factors which had been largely disregarded in the defense system at the beginning of the war. Sound detectors for airplanes play an important part in determining the direction in which to expect enemy aircraft. As soon as the proper deductions are made, necessary orders are given to the searchlight operators, anti-aircraft gunners, and to the pursuit squadrons. Organization and coordination of defenses against night attacks are described. *Luchtvaart*, October 22, 1940, pages 382–383.

Model Airplanes

How to Read Building Plans. Arthur J. Vhay. The reading of blueprints simplified and explained for the builders of model airplanes. *Air Youth Horizons*, pages 8, 9, 1 illus.

Cutting Down the Drag. W. H. Phillips and Bill Tyler. A study of the methods of increasing the performance of gasoline-engined model

airplanes through the application of careful streamlining to the fuselages and extruded members. *Model Airplane News*, January 1941, pages 13, 52–55, 3 illus.

The World Record Flapper. Ed Lidgard. A description, plans and construction directions for the model ornithopter which established a world's record flight of three minutes, one and eight-tenths seconds. *Model Airplane News*, January 1941, pages 14, 15, 39, 40, 3 illus.

A True Pitch "Gas Prop." H. A. Thomas. An outline, layout and a practical method for producing efficient propellers for gasoline models. *Model Airplane News*, January 1941, pages 28, 38, 39, 2 illus.

The Heinkel He.112. Gordon A. Reeves. Plans and directions for building a scale model of the Heinkel He.112-U, a German single seater pursuit airplane. *Model Airplane News*, January 1941, pages 30, 31, 50, 1 illus.

Naval Aviation

Air Power at Sea. The action of the British Fleet Air Arm at Taranto is offered as proof that a fleet cannot operate safely without auxiliary aircraft, even within short range of shore bases. *The Aeroplane*, November 22, 1940, page 560, 1 illus.

Battleships Below. John R. Hoyt. Popularized version of what takes place when patrol bombers are sent to find the enemy fleet. Setting the course, checking for drift, flight through a storm area, with subsequent checking position by means of a celestial "fix," are described. This is followed by the sighting of the enemy and reporting position, action with enemy fighters and escape into the storm area, and the flight back to base. *Air Trails*, February 1941, pages 10, 11, 54, 55, 4 illus.

Navigation

Astronomical Avigation. Frederick Harrison Tregenza. Long range overweather flying is increasing the need for celestial avigation. Fundamentals of the science will be explained in a series of articles, of which this is the first. The writer begins with a description of the celestial sphere and defines terms used in celestial navigation. Hour angles are then explained together with elements of the spherical triangle. Diagrams are used to show more clearly the elements as they are described. *Commercial Aviation*, December 1940, pages 35–37, 48, 58, 5 illus.

Parachutes

Parachute Delivery of Air Freight. Walter E. Gilbert. Description of freight delivery by parachute to government survey parties in Canada. Burlap parachutes are used to drop supplies in fifty pound packages. Details of parachute construction, airplane equipment and methods of packing are given. *Commercial Aviation*, December 1940, pages 45, 46, 4 illus.

American Tough Guys. Photographs of the U.S. Army's parachute troops, showing them donning parachutes and special uniforms, helmets with padded chin straps, and boots with built-in leather ankle supports. In training a spare parachute is carried in place of military equipment. *Flight*, November 21, 1940, page d, 4 illus.

Out of the Blue. Jim Marshall. Outline of the development of American parachute troops. Contrary to popular belief, it is said that the U.S. Army's parachute troop training has not followed Russian or German methods, but is based upon the experience gained by parachute fire fighters of the U.S. Forest Service. David P. Godwin, assistant chief of the Division of Fire Control began training fire fighters in the use of parachutes in 1939, and they were first used in October of that year. The Army sent observers who learned all they could, brought back samples of equipment developed for the Forest Service, and began organizing the parachute corps at Fort Benning. Details of personnel selection, training methods and equipment are given. *Collier's*, January 11, 1941, pages 28–31, 36, 5 illus.

Personalities

Flying Funnyman. An account of the adventures in private flying of Edgar Bergen, noted radio ventriloquist. This article also includes a description of a fund set up by Bergen, from which pilots who want to get their air line ratings can borrow the money for the instrument instruction without interest, and pay it back out of their earnings. *Flying and Popular Aviation*, January 1941, pages 15, 62, 64, 66, 1 illus.

Fighter Pilot V.C. An account of the fight between R.A.F. Flight Lt. D. J. Nicolson who intercepted an enemy airplane during a flight over Southampton. Although wounded, he shot a Messerschmitt 110 down into the sea. Nicolson was the fifth pilot to receive the Victoria Cross. *The Aeroplane*, November 22, 1940, page 561.

Men of the Moment. Details of a series of new appointments of Air Marshals in the R.A.F., with career summaries of the officers. *Flight*, November 28, 1940, pages 447, 448, 1 illus.

Air Chief Marshal Sir Charles Portal. Portrait caricature by Bruce Angrave, with a brief character description of England's new Air Chief. *Aeronautics*, December 1940, page 38, 1 illus.

The Facts About Lindbergh. C. B. Allen. An account of the activities of Col. Charles A. Lindbergh since 1935. Included are the various trips he made to inspect German aircraft plants and European air fields in 1936, 1937 and 1938, and reasons why they were made in a strictly official capacity. It is shown that subsequent developments have proved his estimates of the German air strength, which were scoffed at by the British, to have been on the conservative side. While he is following his father's footsteps by working against involvement in foreign war, he believes that to fight in this one, we should have begun to rearm five years ago. Col. Lindbergh's family life in England and France and his medical work with Doctor Carrel, are also described. *Saturday Evening Post*, December 28, 1940, pages 12, 13, 50–53, 4 illus.

Photography

The Interpretation of Air Photographs. H. J. A. Wilson. Explanation of methods used in the analysis and interpretation of photographs made from the air. Studies in landmark identification are shown together with the various effects of altitude, clouds, light and shadow, and camera angles. *Aeronautics*, December 1940, pages 26–31, 13 illus.

Movie Soldiers. Alexander McSurely. A description of the U.S. Army Corps motion pictures, which are produced for instruction purposes. This article is also history of the Air Corps motion picture unit and an outline of its work, methods and equipment. Personal sketches of some of the key men in this organization are also given. *Flying and Popular Aviation*, January 1941, pages 22–25, 86, 87, 11 illus.

Private Flying

I Learned About Flying From That! Alma Heflin. A girl flyer's account of a forced landing in Alaska. *Flying and Popular Aviation*, January 1941, pages 35, 82, 3 illus.

Campus Pilots. William D. Strohmeier. An account of the activities of the National Intercollegiate Flying Club. This organization was formed to stimulate flying in colleges not having flying clubs, and to encourage intercollegiate air meets. It is stated

that the CPTP has trained many college pilots who are now keeping up their flying, as members of college flying clubs. Some of the intercollegiate competitions sponsored by the N.I.F.C., are described. *Air Trails*, February 1941, pages 12, 13, 56, 7 illus.

Hedge Hoppin' Heroes. Tracy Richardson. Personal experiences of a recruiting agent for British ferry pilots, who entrusted himself and his five-place Stinson to the tender mercies of a Texas crop duster for a test flight. The results, while nearly beyond belief, are amusingly described. *Air Trails*, February 1941, pages 14, 56, 57, 1 illus.

Antelope Express. Charles J. Belden, a prominent rancher of Wyoming, has shipped antelope all over the world by air. Here is an account of such a shipment in a private Lockheed transport to a friend at Lake Placid. *Western Flying*, December 1940, pages 24, 25, 7 illus.

An Unusual Sporting Flight From Rio. T. N. Sandifer. Account of a trip up from Rio de Janeiro in a Stinson Reliant, by Senor Darke Bhering de Mattos and Leigh Wade, former U.S. Army round-the-world pilot. *U.S. Air Services*, December 1940, page 18.

Private Piloting by Instrument. Walter C. Laidley. Log and description of a private pilot's instrument flight from Cleveland to Chicago. Interesting details of flying the radio beam and conversations with both radio range stations and airport traffic control towers, are recorded. *The Sportsman Pilot*, December 15, 1940, pages 14, 28, 30, 2 illus.

To Panama and Back by Rearwin—Part II. Dr. Travis E. Kallenbach. Continuation of an account of a vacation flight to Panama and return. The writer is a St. Louis dentist who flies a Ken Royce powered Rearwin Sportster. Part 1 covered the trip as far as El Salvador. Part 2 contains interesting data on flying conditions in Central America, and describes the remainder of the flight to Panama with brief mention of the trip back to St. Louis. *The Sportsman Pilot*, December 15, 1940, pages 23, 30, 31, 1 illus.

Hanger Flying. (Southern Vacation.) G. H. Dusman. Account of a twelve-day vacation trip in an Aeronca C-3. Starting from Harrisburg, Pa., the writer flew by easy stages to New Orleans, then east along the Gulf shore to Florida, and north to the starting point. Flying time totaled 44 hours at a cost of $45.15. Many details of the trip are given. *The Sportsman Pilot*, December 15, 1940, pages 20, 21, 35, 1 illus.

Propellers

For Greater Efficiency. Description of the Rotol four-bladed propeller. Available with 35 degree variation in pitch, or full feathering, it is equipped with a double-row, ball thrust bearing, and either wood or metal blades. *Flight*, December 5, 1940, page 471, 1 illus.

Airscrew Spinners—I. F. G. Marshall and P. Burton. A discussion of different types of spinner mountings. Included are rigid mountings with detachable spinner assembly, and rubber mountings. Problems of the rubber-mounted spinner, such as vibration frequency and gyroscopic load, are described. *Flight*, November 21, 1940, pages e, f, 3 illus.

Problems of Propulsion. An analysis of the effect of increased horsepower of single aircraft engines on the size and design of propellers to translate that power into thrust. It is shown that with an engine of 5,000 hp. the weight of the propeller would approach that of the engine. Problems of tip speed, size and efficiency of propellers are also outlined. *Aeronautics*, December 1940, pages 74, 75, 3 illus.

Airscrew Spinners—II. F. G. Marshall and P. Burton. (Continued from *Flight*, November 21, 1940, page f.) The first part of this article dealt with current types of spinners. Part 2 discusses the development of spoked, cooling, and bullet-proof spinners. Advantages of the spoked spinner are said to be ease of dis-assembly for servicing and ready standardization of production in various sizes. The cooling spinner is being developed to cool and streamline radial engines, while bullet-proof spinners will add to the frontal protection of military aircraft. *Flight*, December 5, 1940, pages 467, 468, 3 illus.

Radio

German Radio Equipment. Description of standard German radio units in the Messerschmitt Me-109, and the more elaborate equipment found in the Me-110, the Heinkel He-111K, and Junkers Ju-88. The latter installation is known as the F.u.G.10. Details of design and construction are shown. *Flight*, November 14, 1940, pages g, h, 5 illus.

A New Radio Aid to Air Navigation. David G. C. Luck. Description of the RCA u.h.f. omnidirectional beacon, and a cathode ray tube azimuth indicator which shows the true bearing of the range station regardless of the heading of the receiving aircraft. By tuning-in to two or more omnidirectional range stations, a true, cross-bearing, radio fix can be plotted without the usual compass corrections. A course deviation indicator is also being developed for use with the system. *Aero Digest*, January 1941, pages 49, 50, 53, 54, 56, 232, 7 illus.

Private Radio's Handcuffs. Moulton Taylor. An analysis of problems which handicap growth in the adoption of two-way radio equipment for general use in light airplanes. These include the problem of a station and an operator's license for the airplane transmitter and operator, talk of the imminence of u.h.f. equipment which would render obsolete low frequency transmitters and receivers, installation problems presented by certain types of light airplanes. A 14-pound two-way portable is shown and described. *Western Flying*, December 1940, pages 26–28, 5 illus.

Airlines' Radio Receiver Requirements Met with a 24-pound Receiver. David S. Little. Details of a small, light weight radio receiver, developed to air line specifications by Harvey Wells Communications, Inc., of Southbridge, Mass. *Aero Digest*, January 1941, pages 45, 46, 236, 3 illus.

Stress Analysis

Models in Aeroplane Design. J. Taylor. A discussion of model requirements for the study of strength and stiffness as well as aerodynamic properties. The use of scale models in testing aerodynamic characteristics is well established. However, the increasing size of aircraft being designed may make a type of scale model for the study of strength and stiffness feasible. This article correlates the different types of models used in these tests and indicates the extent to which they could be used to study both flying characteristics and structural strength. Some of the difficulties and inaccuracies encountered in this type of testing and the practical limits of the application of this combined type of model are outlined. *Aircraft Engineering*, November 1940, pages 322–324, 328.

Knickbiegeversuche. (Buckling Strength Tests.) J. Cassens. This report presents formulas by means of which the buckling load of a rod stressed on both ends by an eccentric load may be calculated. The calculation is extended especially to the elastic field. Calculations are made according to three different methods; two of them are independent of the material —in the elastic field. The third method which is dependent on the material, is more exact, and is used to compare test results with calculation results. *Luftfahrtforschung*, October 26, 1940, pages 306–313.

Some Observations on the Theory of Contact Pressures. Stewart Way. The stress system in a semi-infinite elastic solid with given normal surface loading is of importance in many problems of machine and structural design and the strength of materials. Often, in such cases, the stresses on the surface of a body are of primary interest. This article presents observations that can be made regarding these stresses and displacements in the surface. *Journal of Applied Mechanics*, December 1940, pages A-147–157.

Convergence of Hardy Cross's Balancing Process. Rufus Oldenburger. It is shown that the Cross method of structural analysis may be applied to a given structure in such a manner that the process does not converge. In this article, the writer gives necessary and sufficient conditions for the convergence of the Cross method and exhibits a convergent process of balancing any given structure. In particular, he shows that a balancing process can be described by a linear transformation, that is, by a matrix of real numbers, and that the process converges in the sense of this paper if and only if the infinite power of this matrix exists and is zero. The study is restricted to the case of a continuous beam. *Journal of Applied Mechanics*, December 1940, pages A-166–170.

Analysis of Clamped Rectangular Plates. Dana Young. An analysis of an attempt to solve the problem of the bending action of rectangular plates which have been clamped on all four edges and subjected to lateral load. The writer's investigation was based on the ordinary theory of bending of thin plates as treated in Lagrange's equation of the middle surface. The superimposition method was used and applied to a number of loadings which, thus far, had not been studied. *Journal of Applied Mechanics*, December 1940, A-139–142.

The Impact of a Mass Striking a Beam. E. H. Lee. The integral equation for the horizontal impact of a mass on a beam, developed by Timoshenko in 1912, applied the numerical method of solution by dividing the time into small increments during which the contact force was applied as a constant. This method, according to the writer, is too lengthy to be applied in practice. The article presents an approximate solution, assuming that the duration of the contact is small in comparison with the period of the fundamental mode of vibration of the beam, and only the fundamental mode of oscillation of the beam need be considered. In some cases, good agreement is reached between the lengthier and the shorter method. Others show large discrepancies, both in the contact force and the resulting motion. The article describes the method of the shorter solution, and explains the difficulties in using a solution based on energy and momentum considerations. *Journal of Applied Mechanics*, December 1940, pages A-129–138.

Stable and Unstable Equilibrium of Plane Frameworks. N. J. Hoff. In dealing with the stress analysis of the side panel of a welded steel-tube aircraft fuselage, or of any similar framework, two independent questions arise. First, the stresses due to the axial forces, and to the bending moments caused by couples or by external loads applied between joints, must be checked against the allowable values. Second, it must be ascertained that the magnitude of the applied load system is smaller than the first critical (buckling) load of the structure.

The actual calculations involved in the first question are relatively simple. Any standard method based upon the assumption of pin joints may be used in computing the axial forces. To determine the bending moments in the bars James's adaptation of the Hardy Cross method is usually simplest.

Methods for treating the stability problem are referred to in the article. *Journal of the Aeronautical Sciences*, January, 1941, pages 115–119.

Ueber ein besonderes Ersatzsystem zur Berechnung von Fluegelschwingungen. (On a Special Substitution Method to Calculate Wing Vibrations.) W. Biermann and W. Dessecker. Determination of frequencies of various types of vibrations by means of conventional methods generally requires a large number of iterations and integrations, when there is a non-continuous distribution of masses and stiffness. Due to its great adaptability the above method is especially practicable to determine these non-continuous distributions. *Luftfahrtforschung*, October 26, 1940, pages 314–319.

Beam-Column End Moments for Known Fixity Coefficients. Frank B. Wozniak. A method for calculating the restraining end moments for pure columns which must be designed as beam columns carrying one or more concentrated lateral loads. The method can be used for any end fixity coefficient less than four. *Aviation*, January 1941, page 52.

Warfare

Italy as a Target. Captain Norman Macmillan. Outline of a plan for extending bombing operations against Italy. Developments in Greece and Albania have made Italy more vulnerable to bombing attack by aircraft operating from Greece. The writer divides Italy into three attack areas, and suggests the disruption of transportation facilities before Germany is able to lend effective aid to Italy. *Flight*, November 28, 1940, pages 451–453, 1 illus.

The Beating Noise of Aircraft. T. S. Littler. A study in aircraft sounds. The throbbing hum of multi-engined bombers and airplanes in formation is analyzed for the purpose of aiding in identification and judgment of distance from the listener. *Aeronautics*, December 1940, page 35.

Bomb Hazards Assessed. A mathematical weighing of danger from exploding bombs. Risk at various distances from the crater of an average bomb is shown and a comparison given between the relative safety of city and country residents. *Aeronautics*, December 1940, pages 52, 53, 2 illus.

The Netherlands as an Air Spring Board. Review of the possibilities offered by the Netherlands as a jumping-off point for the invasion of England. Various German military writers on the subject are cited to show how firmly the idea has been rooted in the general plan of attack on England. Possible strategy is outlined, including the use of parachute troops and air transport for infantry. *Aeronautics*, December 1940, pages 70–73, 20 illus.

Oil and the Aegean. Captain Norman Macmillan. Analysis of Germany's problem of oil supply and the strategic importance of the Aegean, Dardanelles and the Bosphorus. Germany must control all three and insure passage of shipping through the Mediterranean in order to concentrate enough tankers in the Black Sea to transport necessary oil supplies from Russia. Also included is a suggestion that the R.A.F. organize mobile self-contained units so that airplanes, ammunition, fuel, personnel, and maintenance facilities could be transferred upon short notice to anywhere they might be needed. It is stated that organization and training such units might well be done in Canada as part of the Empire Training Plan. *Flight*, November 21, 1940, pages 434–436, 1 illus.

Italy as a Target—II. Captain Norman Macmillan. Further discussion of air bombardment of Italy, especially of Rome. It is said that as Venice and Vienna were not bombed, by mutual agreement, in the first World War, some such agreement should be possible between England and the Axis powers for the preservation of historical treasures vulnerable

to air attack. The writer suggests bombing the air fields around Rome to show it can be done, and follow up the attack with a demand for "scheduled zones" for England and Italy. (*Ed. Note: This article was written before the bombing of the inner city of London.*) *Flight*, December 5, 1940, pages 469–471.

Rumm—Rumm Bird. C. Campbell. Study of the identification of aircraft by sound. Reasons for a throbbing beat heard at high altitudes are explained together with causes for differences between the beat of German and British aircraft engines. The differences between aircraft sounds at low and at high altitudes are also discussed. *Flight*, November 14, 1940, page 412, 1 illus.

Taranto. Pictorial documentation of damage done by British torpedo aircraft to the Italian fleet at Taranto. Several damaged battleships and cruisers are shown. *Flight*, December 5, 1940, pages 476, 477, 25 illus.

Implications of the English Torpedo Plane Attack on Taranto. Guy W. S. Castle. Tactical analysis of the British torpedo aircraft action at Taranto. Results of the raid are weighed as evidence concerning the question of airplanes *versus* battleships. *U.S. Air Services*, December 1940, pages 12, 13.

"Spitfire" . . "Hurricane" . . Anti-Aircraft . . and the Bombers. A picture survey of Royal Air Force activities. One part is a strip taken from newsreel negatives, showing Hurricanes and Spitfires repelling an attack on a convoy in the English Channel. Also included are pictures taken by reconnaissance airplanes in Germany of military objectives, of enemy aircraft shot down in England, of the equipment of the Fleet Air Arm and of aid from abroad in the form of airplanes from the U.S. and volunteer pilots from Poland. *War in Pictures*, September 1940, pages 4–7, 28 illus.

The Fight for Air Supremacy. A comparison of the pilot losses sustained by German and English Air Forces. According to this article, the ratio of losses is twelve to one in favor of R.A.F. due to the fact that most of the air battles are fought over England. *Neptune*, October 1940, pages 16, 17, 6 illus.

Americans Study Air-Raid Safeguards. Survey of A.R.P. (air raid precaution) activity in the United States. Engineers and architects are being given courses in the design and building of bomb shelters, civilians are being trained in fire prevention and control, a master plan for fighting incendiary attacks is being worked out by the New York City Fire Department, under commission by the War Department. Types of bombs and their effects are described. *Popular Science*, February 1941, pages 96–98, 237, 5 illus.

The End of an Italian Submarine. Photographs of the sinking of an Italian submarine by bombs from a Short "Sunderland" flying boat. *Neptune*, October 1940, page 21, 3 illus.

So Many Owe So Much to So Few. Vincent Sheean. Analysis of the war in the air for the general reader. It is stated that while Germany was able to try out and perfect many of her Blitzkreig methods in Spain, the invasion of England involved a new element—the English Channel, and tactical problems which as yet have not been solved. Most of the article describes the defense of England by the R.A.F., with considerable space devoted to description of German and British military aircraft. *Saturday Evening Post*, December 21, 1940, pages 9–11, 70–72, 6 illus.

Personal Slants on the Air War. Wallace Ward. Series of anecdotes on air combat as told to the writer by Air Marshal W. A. Bishop. Most of them concern the activities of No. 1 Fighter Squadron of the Royal Canadian Air Force. Effectiveness of some of the older types of British military aircraft is also described. *Canadian Aviation*, December 1940, pages 20–23, 50, 53, 7 illus.

Battle Scars. Paul H. Wilkinson. Pictures illustrating the extent to which modern, all-metal military airplanes can be damaged in combat and still remain in the air. These photographs show aircraft of the German Luftwaffe, parts of which were shot away while in flight, which were able to return to their bases due to their inherent structural strength and to the skill of their pilots. *Aviation*, January 1941, pages 34, 35, 7 illus.

De Japansche Luchtmacht in China. (The Japanese Air Force in China.) In her war with China, Japan uses now modern, long distance bombers. How many she has is not known. However, lack of raw materials and fuel promises to limit their use, and, should the war spread to the western hemisphere and into the Pacific, Japan's position in raw materials would be highly problematical. *Luchtvaart*, October 22, 1940, pages 394–396.

Parachutisten boven Holland. (Parachute Troops Above Holland.) An eye witness account of the invasion of Holland, describing the attacks near and in Harlem, Amsterdam and Rotterdam. It is stated that parachute troops, with the aid of fifth columnists, spread terror and confusion among the defenders and the defenseless population. Many of these parachutists wore Dutch uniforms. They were able to take up important positions, and, with the help of bombing squadrons, paved the way for German tank and infantry divisions. *Luchtvaart*, October 22, 1940, pages 391–393.

Miscellaneous

If You Can Take It. Cecile Hamilton. Advice to young women who are seeking a career in aviation. Examples of women who have reached high places in aviation are given along with the counsel that "there is no short cut to a career in aviation." Some of the present opportunities for the employment of women in aviation are named, and future vocational possibilities are discussed. *National Aeronautics*, December 1940, page 28.

Will Air Racing Come Back? Hubert Broad. Contributions of air racing to aircraft design are outlined together with the classes of air racing which would be of most value in the future. *Aeronautics*, December 1940, pages 87, 88, 4 illus.

Illusions by Camouflage. Explanation of modern methods of camouflage. Problems of camouflaging aircraft as well as concealment of factories from the air are discussed. *Aeronautics*, December 1940, pages 68, 69, 2 illus.

The Guide. Wesley Carty. The Official Aviation Guide, first published early in 1929, has grown to be the air transport "bible" of the United States. This monthly magazine contains up-to-date airline schedules and maps for all of the domestic airlines and as many foreign systems as are available. The history of the publication is outlined with a description of the unique method by which it is assembled and published. *Flying and Popular Aviation*, January 1941, pages 40–42, 89, 4 illus.

Miscellaneous Equipment

File Recovery. Description of an acid bath method of reconditioning files to 97 percent of efficiency when new. Active life is said to practically equal that of a new file, at only 25 to 50 percent of the cost. *Aircraft Production*, December 1940, page 392, 2 illus.

Testing an Aviation Floodlight. H. W. Wrigley. A description of the method and equipment used by the Westinghouse Electric & Manufacturing Co. for the testing of airport floodlights. The equipment consists of a trunnion or movable platform for mounting the light and a light intercepting device for checking the intensity of the beam in any position desired. *Aviation*, January 1941, page 64, 1 illus.

From the Industry

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Review.

Civil Aeronautics Administration

Construction or improvement projects on 200 airports in the United States and its possessions, approved by a priority board consisting of the Secretaries of War, Navy and Commerce as necessary to the national defense, have been announced by Col. Donald H. Connolly, Administrator of Civil Aeronautics.

The program was authorized in a $40,000,000 appropriation passed by Congress in October. The appropriation was made "for the construction, improvement and repair of not to exceed 250 public airports. . .determined by the Administrator, with the approval of a Board composed of the Secretary of War, Secretary of the Navy and Secretary of Commerce, to be necessary for national defense."

Colonel Connolly pointed out that the program, as approved by the cabinet board, has been designed to provide the maximum number of completed and usable units of improvement possible, rather than the completion to their ultimate classification of only a few airports.

"I want to make it clear, however," he added, "that this does not mean we will merely start a great many developments. Actually, we have 23 percent fewer projects than the limitation placed by law. And every project we have listed is so planned that it will be a complete improvement unit, available for landing use without additional expenditure upon it.

"Improvements are being undertaken only where the land is owned by a political subdivision of Government which is prepared to make it available to the Federal Government without cost, and further to pledge itself to maintain and operate the improved airport.

"Improvements under this program have been limited to development of actual landing facilities, as these are essential; and none of our funds are being used for buildings, hangars or other facilities not actually a part of the landing field.

"This policy is, of course, dictated by necessity. Our purpose, therefore, is to provide completed and useful improvement units at as many strategic locations as our funds will permit."

Aeronautical Chamber of Commerce

A new type of wind tunnel in which the entire engine section of an airplane can be tested under flight conditions before the plane itself is even built has just been placed in operation at the Vultee Aircraft factory near Los Angeles.

Considered of far-reaching importance as a means of speeding the development of new military aircraft designs, the tunnel symbolizes the strides made by the American aircraft industry in meeting the national defense program needs.

Vultee engineers expect these "laboratory flight tests" to lead to elimination of one-half to two-thirds the usual time required for actual flight tests.

For, by running the tunnel tests of a power plant installation (which consists of assembled engine, propeller, cowling, etc.) in advance they will be able to solve major problems which otherwise would not be encountered until after the prototype of a new line of airplanes has been completed and taken into the air.

Under this arrangement, the power plant installation would be completed ahead of the other sections of the plane, the reverse of the usual procedure.

Designed to reproduce conditions encountered in actual flight, the new tunnel is in two "pieces." The entire engine section is mounted in the throat of one of these and the usual ground tests are run. Then the first tunnel section is rolled forward on tracks and coupled to the second section, known as the "booster."

This contains a 1,000-horsepower electric motor propelling air at regulated velocities to compensate for the movement of an airplane in a power climb.

With the extensive instrument facilities possible under laboratory conditions, as compared with the limited number usable in an actual test flight, engineers say they can gather much more comprehensive and accurate data than otherwise would be available in the time required for completing the tests.

According to company executives, Vultee is the first aircraft manufacturer to extend the usual ground cooling test methods for engine sections to include simulated conditions of flight.

A year's end statistical round-up today showed a record of accomplishment in the American aircraft industry's first national defense job—plant expansion.

Decks are cleared for the industry's 1941 task—large quantity production of military planes.

While accomplishing tremendous expansion of plant and shop personnel, the manufacturers of airplanes, engines, propellers and accessories more than doubled production, the Aviation News Committee of the Aeronautical Chamber of Commerce reported.

Pointing out that the thousands of airplanes required for national defense could not be built without the necessary plant facilities, the committee said:

"Expansion was the aeronautical industry's job in 1940—that and the hiring and training of men to build the airplanes needed by the United States and Great Britain. How well the industry has handled its 1940 assignment may be judged by the following statistics:

"At the start of 1940 the industry had 11,983,896 square feet of working space. At the end of 1940 this total had been expanded to more than 22,500,000 square feet.

"On Jan. 1, 1940, there were 60,000 productive workers employed. On Jan. 1, 1941, that figure had risen to better than 165,000.

"In other words, the aeronautical industry doubled its productive working space, spending more than $83,-

000,000, and providing employment for thousands of construction workers. It practically tripled its employment rolls.

"And while it was doing all this, the industry was still able to make spectacular gains in production. The dollar value of airplanes delivered in 1940 was more than two and a half times that of 1939."

National Advisory Committee for Aeronautics

(Ed. Note: The following has been condensed from the 26th Annual Report submitted to Congress, November 26, 1940.)

The Committee has found it necessary in the national interests to withhold from public distribution the detailed results of its researches. Therefore, until world conditions change, this and succeeding Annual Reports will deal only in general terms with the results accomplished.

This report describes in general terms many investigations now in progress, each of which may be expected to add something in speed, maneuverability, load capacity, range, safety or economy, to the merit of American airplanes. Several of these investigations already definitely promise large advances. The Committee has been called upon to investigate problems of immediate importance to the Army and Navy involving the means of obtaining the quickest and greatest possible improvements in the performance of aircraft. The Committee's function therein is limited to questions of aeronautics. Designing adapted to meet military requirements lies in the province of the military services.

The most significant developments of the past year in relation to the Committee's work may be briefly summarized as follows:

1. A rapid trend for the improvement of aircraft performance growing out of the war in Europe and reflected in the demands upon the Committee by the Army and Navy for basic new data essential for the design of aircraft of ever-increasing performance.

2. Great expansion in aircraft production requiring the development of quantity production methods.

3. An extensive Army and Navy experimental program for the production of new types of aircraft to meet constantly increasing performance requirements.

4. The authorization by law of an aircraft engine research laboratory which will be a third major research station for the Committee.

The outstanding trend produced by the present war in Europe is toward the development of aircraft having higher speeds and greatly increased armor and armament.

To meet the requirements of increased air speed, special research studies have been made of airplanes in current production and also of experimental types. These studies have included investigations in the full-scale wind tunnel in the Committee's Langley Field laboratory and also the study of the drag of component parts.

The demand for increased speed has resulted in the need for much greater horsepower. Whereas pursuit airplanes of a year ago were equipped with engines of 1,000 horsepower, they are now being designed with single engines of 2,000 horsepower. The trends toward

Air Associates' new type spinner for a four-bladed propeller.

increased speed and higher ceiling, toward larger and heavier engines, toward increased armor and armament, necessitate larger and much heavier types of airplanes. This condition has established a definite trend toward higher wing loadings.

Because of the higher flying speeds demanded by the Army and Navy, the Committee has given special study to the important subject of compressibility shock encountered at high speeds. With the speeds now attainable, it is essential that care be taken to design all parts of the airplane structure so as to prevent velocities approaching the speed of sound from occurring at any point. The 500-mile-per-hour wind tunnel at the Committee's Langley Field laboratory has proved of great value in the study of this problem.

With increased wing loading, it has become necessary to extend the study of improved high-lift devices and of lateral-control devices other than ailerons so as to permit the development of a full-span flap. The trend toward higher speeds has brought many attendant problems, such as the need for improved methods of cowling and cooling of engines, the design of wing ducts, and of ducts for the cooling of engine auxiliaries. High operating speeds also make it necessary to give special attention to the design of air scoops and ventilators.

The Peddie School

Dr. Wilbour E. Saunders, headmaster of The Peddie School, a boys' private preparatory school at Hightstown, N.J., has announced the addition of an aviation course to the school's program for its students. The course will consist of a Ground and Flight Training program in conjunction with the Bennett Air Service which is located at the Central Jersey Airport at Windsor, N.J.

The Ground School will be conducted by Peddie in the school's class rooms under the direction of William Boyd, a member of the Peddie science department who has had practical aviation experience. The course will use the Civilian Pilot Training Program set up by the government for use in college courses. Students must be sixteen years of age to register for this part of the work and may take it separately from the flying course. The ground course will start immediately after the close of the school's Christmas vacation, January 6th, and will run for nine weeks.

Flight instruction will be given by the Bennett Air Service, whose president is Alfred B. Bennett, an alumnus of Peddie of the class of 1925. Besides handling the Peddie course the Bennett Air Service has for the last year handled the C.A.A. training program for the Princeton University unit.

Air Associates

A propeller spinner designed to cover entirely the nose and hub of the Curtiss four-bladed, full-feathering propeller has been added to the line of spinners manufactured by Air Associates, Inc. The new spinner, weighing approximately 21 pounds, completely streamlines the hub of airplanes equipped with the Curtiss four-bladed propeller, giving an even air flow over engine and cowling.

Propeller anti-icing equipment is available for incorporation in the spinner if required. This combination of anti-icing equipment and spinner has proved very successful on many types of airplanes. For spinners used on airplanes operating from salt water an alumilite corrosion resistant finish is applied.

Cadillac-Allison

"The chief difference between automobile and airplane engine production," explained Nicholas Dreystadt, general manager of the Cadillac Motor Car Division, "is not so much the design of the parts. It lies rather in the narrower limits with which we work. Precision to the ten-thousandth of an inch is not unknown with automobiles, but the aircraft engine possesses many more parts where this exacting fit must be achieved."

As a striking illustration of the point, the Allison supercharger carries a guide vane that turns nine and one-quarter times engine speed or usually at 24,000 revolutions per minute. It is an extremely intricate piece of alloy steel with fins curving outward from the hub. Previously the part was built by hand. Cadillac produces the same vane by putting it through 24 separate machines.

Demands of precise workmanship, further, have nearly always resulted in a high percentage of aircraft parts rejections. This waste was more or less expected. Cadillac, however, by applying the same principles that it uses in the production of automobiles, has reduced sharply the amount of waste.

"Fortunately, we have been able to handle the defense job without any interruption in our regular business," Mr. Dreystadt said. "A predominance of skilled and veteran employes, that normally exists in the manufacture of quality merchandise, has permitted us to train an efficient aircraft parts personnel."

The Allison engine is naturally a favorite with automobile men since it is the result of automobile engineering and research. In 1929, when General Motors purchased the company, the concern was primarily known for aircraft bearings. Working on replacements for the old Liberty engine after the war, it had developed a steel and bronze bearing of unusual merit.

Under General Motors, Allison first built a six-cylinder aircraft engine and later brought out a twelve-cylinder liquid-cooled engine for test by the Army in 1935.

Liquid cooling permits an in-line piston assembly and a consequent reduction in head resistance from the radial or star-shaped type. With a frontal area of six and one-half square feet against 16 square feet for the radial of comparable horsepower, the engine likewise lends itself to locations other than the nose of the plane.

Curtiss-Wright Corporation

Commenting upon President Roosevelt's address urging greater American aid to Great Britain, G. W. Vaughan, president of Curtiss-Wright Corporation, disclosed that mass production at his organization's Curtiss Aeroplane Division at Buffalo, N.Y., has reached a point enabling the delivery of eight fighter planes daily to Great Britain's R.A.F.

All of these planes, he said, are of the fast, highly maneuverable Curtiss Hawk 81A pursuit type which Great Britain's R.A.F. in turn has named the "Curtiss Tomahawk." This type, he explained, is a development of the Curtiss P-40 pursuit, large numbers of which have been delivered to the U.S. Army Air Corps.

A comparator, used for inspection at the Cadillac-Allison Division of General Motors, which enlarges the shadow of a part as much as a hundred times. A bolt thread is shown under examination. To meet specifications, the magnified image must coincide with an outline on the screen.

In addition to producing fighter planes for Great Britain, Curtiss-Wright Corporation's Buffalo factory—America's largest producer of combat planes for the National Defense—is manufacturing and developing new aircraft types for the U.S. Army Air Corps and the U.S. Navy. More than 9,000 workers are employed in this plant alone.

Douglas Aircraft Company

Streamlined assembly technique is bringing the long-sought mass production goal into sight at America's largest airplane manufacturing plant.

Under a national defense drive now in full swing, Douglas engineers and production experts have already successfully attacked one enemy of efficiency—waste of materials—and are now conquering waste of time and motion through unique productive arrangements.

New high-speed airplane assembly methods going into effect at the company's main plant here, slash radically the elapsed time between fabrication of parts and completion of the airplane, and open new vistas of larger production in shorter time for less money.

Preliminary plans for speeding up shop departments and assembly lines by reorganizing them on a "progressive" basis, were mapped months ago by a newly-created plant layout department. Its aim, to send parts and materials through the factory in unbroken, continuous flow until they roll out the door in the form of finished airplanes.

Involved in the program were streamlined production lines, revamped and regrouped departments, assembly jigs on tracks, relocated equipment and rerouted movement of materials.

The new methods are proving so effective in the departments already "streamlined," that the famed automotive plants which are to build parts and assemblies for Douglas airplanes on a subcontracting basis, have sent experts to the Santa Monica plant to study and adapt its production line layouts to their own use.

Wherever the progressive or straight-line technique has been launched, scheduling and planning have been found greatly simplified, handling of materials is reduced by elimination of backtracking and crosshauling, and production per given area of floor space is nearly doubled.

In formulating the new layouts, thousands of paper models are utilized to represent machines and jigs and airplane assemblies. Department by department, these are placed on huge charts of the plant, analyzed and studied precisely and painstakingly, and finally arranged in such a manner as to allow materials to stream down the line in the fastest, most efficient manner possible.

With production swiftly accelerating as new layout plans take effect, operations today show further gains from scores of glistening new high-speed precision machines. Nearly a million dollars worth of additional machinery and equipment of all types went into the plant's humming production lines during 1940.

Greater use of the automotive industry's resources and personnel in speeding up defense production of aircraft is provided in large sub-contracts just signed by Douglas Aircraft Company.

Immediate increases in employment and installation of additional production facilities costing millions of dollars will result at plants in eastern industrial centers, it was disclosed here today by

Walter A. Hamilton, Douglas Company's chief of materiel.

Contracts with automotive plants for airplane sub-assemblies first pioneered by Douglas have been completed and signed by the company and Murray Corporation of America, and Briggs Mfg. Co., both of Detroit, Mich.; Fleetwings Inc., Bristol, Pa.; and McDonnell Aircraft Corp., Robertson, Mo.

Largest of the orders exceeds $30,000,000, while the total of those already signed or in final stages of negotiation may eventually pass the $100,000,000 mark, it was stated.

In addition to their industrial significance, the sub-contracts are in line with President Roosevelt's request for accelerated defense production.

Douglas launched negotiations with the eastern sub-contractors months before it signed huge contracts with the United States Government, and it now becomes the nation's first major airplane manufacturer to put to use the automotive industry's surplus production capacity in building sub-assemblies for military aircraft.

Under these contracts eastern plants will manufacture wing sections, tail groups, landing gear, engine nacelles and other major units, to be assembled into complete airplanes at the huge new Douglas factory under construction at Long Beach, Calif.

Fisher Body division of General Motors is now in production on jigs, fixtures and other tooling for the Long Beach plant.

Although formal approval by the government is necessary in expenditures for increased facilities at plants of the sub-contractors, Hamilton revealed actual engineering work is already in progress, thereby avoiding unnecessary delay in production.

At the same time Hamilton disclosed the first details on transcontinental "shuttle trains" which will operate between the eastern factories and the Long Beach assembly plant. All necessary permits, he said, have been obtained to operate 150 or more cars specially-equipped for carrying airplane sub-assemblies. Participating roads are Union Pacific, Southern Pacific and Santa Fe, and their connecting systems.

Under supervision of Paul W. Milburn, traffic manager of the Douglas materiel division, government inspectors, and railroad engineers, test runs have already been made through western mountain passes. Cars used were of the largest standard type, equipped with steel floor and extra-wide doors, and roof raised to accommodate large sub-assemblies. Special racks were provided, to which sample wing sections were bolted, without any crating. Instruments then measured stresses as the train stopped, started, moved at full speed.

So successful were these test runs that a number of cars have already been remodeled and equipped to await the first shipments.

Headquarters have been established in Detroit, it was announced recently, for a contingent of Douglas materiel experts assigned to supervise the vast flow of equipment, parts and sub-assemblies from eastern industrial centers to the company's plants in Southern California.

As the new sub-contractors join 2,000 other suppliers who already are pouring materials into humming Douglas production lines, the company's preparation for tremendously augmented national defense output moves into high gear.

Expansion in men, machines and production space continues on three fronts, with nearly 21,000 Douglas employes already working around-the-clock at the Santa Monica and El Segundo plants, and construction proceeding night and day on the new "blackout" factory at Long Beach, whose completion will bring the company's employment to more than 40,000.

The Glenn L. Martin Company

News that The Glenn L. Martin Company's factory at Middle River is already tooled for quantity production of its hard-hitting "Flying Torpedo," the B-26, has emerged here as the medium bomber entered the advanced stages of its flight tests. Moreover, Martin officials admitted that the first ship is not a prototype, but is actually a production model and that others are right behind it on the assembly lines.

As long ago as last winter Martin realized that the type, for which it held a contract for around $18,885,000, was likely to play an important part in national rearmament. Without waiting for further contracts, the company quietly went ahead with a tooling operation far more costly than the original order justified. The consequence was that heavy contracts awarded recently—one for $16,337,760 and another for $99,641,880—found the factory already far ahead in its production schedule.

Arrayed on two floors of the big "Military Bay" at Middle River are heavy steel jigs and fixtures and permanent machinery. Overhead are additions to the elaborate monorail system for moving whole sections of airplanes through the stages of construction. A straight-line flow of remarkable simplicity has been worked out.

"We are in position to move rapidly now," said Glenn L. Martin, president of the company, "and tooling operations for our expanded plant are progressing concurrently with the building of the first additions. If we appear to have taken long chances in this tooling performance and in beginning the extension of our factory facilities well ahead of the signing of government contracts, we felt that immediate preparation for the national defense was imperative and that our full assignment would be made known to us at the proper time. It has turned out as we expected."

Owens-Corning Fiberglas Corporation

For the first time in the history of aviation, airplane wings have been covered with glass cloth and tested in actual flight. The tests are being made with the light plane manufactured here by the Taylorcraft Aviation Corporation.

Test pilots and industrial engineers found the results of the first flight satisfactory and predicted the widespread use of the glass cloth, known as Fiberglas. Manufactured by Owens-Corning Fiberglas Corporation, Toledo, Ohio, and developed at its Newark, Ohio, research laboratories, the glass cloth is held to be ideally suited for airplane wing and fuselage covering. Unlike other airplane fabrics it does not shrink or stretch in the presence of moisture, does not rot, and it is unaffected by sunlight or temperature changes encountered in flying.

The glass cloth is described as having an extremely high strength–weight ratio; that is, it is lighter and stronger than standard cotton cloths used for wing covering, and it retains its light weight as it has a substantially lower moisture pickup.

Glass does not burn. Hence the underlying Fiberglas fabric—woven entirely of pure glass in fibrous form—is completely fire-resistant, and impregnation of the glass cloth with incombustible dopes being developed indicates the possibility of producing a plane that is potentially firesafe in flight and on the ground.

Piper Aircraft Corporation

W. T. Piper, President of the Piper Aircraft Corporation, today suggested a possible means for curbing private flying accidents. He pointed out that nearly 85% of the accidents during the past year were due to violation of federal and state regulations. "The greatest single factor entering into accident causes," said Mr. Piper, "is pilots without licenses carrying passengers. Forty-one percent of the 1940 accidents in-

(*Continued on page 35*)

House Organs and Catalogues

Round-the-World Flight

The Guba's Flight. . . Richard Archbold. On the third expedition by The American Museum of Natural History to New Guinea, a Consolidated flying boat, the now famous "Guba," was used to transport men and supplies to the collecting camps in the interior. The "Guba," which in Motu language means "sudden storm," was flown from San Diego to New Guinea. After its work with the expedition was completed the members of its crew undertook to make a survey flight across the Indian Ocean from Australia to Africa, for the British Government, on their way home to the United States. An account of the flight is given. *The Consolidator*, Christmas Issue.

Aviation Oxygen Mask

Six page folder-catalogue giving descriptive details and prices of the B-L-B Sub-Strato Mask and oxygen equipment, as offered by the Ohio Chemical & Mfg. Co.

The Purchasing Department

Purchasing. Howard Golem and Charles T. Leigh. Description of the organization and operation of the purchasing department of a large aircraft manufacturer. *The Consolidator*, Christmas Issue.

Flight Operators Organize

The National Aviation Training Association, recently organized at a meeting of flight operators held at Kansas City, has been formed to extend and improve aviation training, and civil airport facilities; to seek continuation and extension of the Civilian Pilot Training Program; to eliminate fraudulent schools and deceitful advertising; and to contribute in any way to the advancement of aviation in the United States. Officers of the new organization include William A. Ong, Kansas City, Leslie H. Bowman, Ft. Worth, Col. Roscoe Turner, Indianapolis, and James C. Bennett, Jr., Louisville. An outline of the meeting, plans and news of the association is contained in this first issue of their official publication. *N.A.T.A. Climb*, December.

Market Research at Lockheed

"The Customer Builds Lockheeds." A description of the work done by the Market Research Division of the Lockheed Aircraft Corporation. This division, part of Lockheed's sales department, is charged with the study of problems relating to air transportation. This article tells how they determine by interviews, circulars and letters, what improvements Lockheed customers want in their airplanes. *Lockheed Aircraftsman*, December.

Personnel Training at Pratt & Whitney

The Pratt & Whitney Aircraft Division of United Aircraft Corporation, faced with the problem of increasing its number of trained plant personnel from 2,700 in 1939 to an expected total of 20,000 in 1941, has cooperated in the establishment of a completely equipped training school in an unoccupied floor of a machine plant in Hartford. Pratt & Whitney has contributed machine tools, material, fixtures, and special instruction. The State provides classroom instructors, clerical staff, light and power. The course takes eight hours a day, six days a week and covers 180 hours of instruction, although 320 hours are available. Graduates are put to work in the East Hartford plant immediately. United Aircraft Corporation, *The Bee Hive*, November-December.

U.A.L. Scholarships

Awards and eligibility requirements for four scholarships to the Boeing School of Aeronautics, offered by the United Air Lines. The competition is open to undergraduate college men. Aeronautical essays or treatises are submitted by the candidates and judged according to the rules outlined. *Boeing School News*, Scholarship Edition.

Aircraft Controls

Descriptive bulletin featuring Simmonds Corsey Flexible Push-Pull Controls. Includes information on construction, operation at various temperatures, uses, installation and servicing, and a description of low temperature tests. *Simmonds Corsey Controls*, issued by Simmonds Aerocessories, Inc.

Effect of Altitude on Airtight Cartons

Eastern customers of a San Francisco florist complained that the gardenias received by air express arrived crushed and bruised. It was noticed by U.A.L's cargo department that the flowers were shipped in heavy cardboard boxes sealed airtight with cellophane tape. One of these packages was placed in a bell jar with a barometer, and the altitude pressures of the west-east flight were simulated. It was discovered that the box of flowers, sealed airtight at sea level, began to bulge at 8,000 feet. At 12,000 it started to leak, equalizing the pressure. When the pressure returned to normal, the box collapsed, crushing the flowers. A few holes punched in the box eliminated this difficulty. *Boeing School News*, December.

Defense Production

Current Designs in Production. L. M. Laddon. Description of various types of aircraft being produced by the Consolidated Aircraft Corporation. *The Consolidator*, Christmas Issue.

The Case for Large Flying Boats

Seaplanes and National Defense. C. A. Van Dusen. The case for large flying boats as military bombers, presented by an executive of Consolidated Aircraft Corporation. While there will always be landcraft for the Air Corps, landing fields for large bombers together with their maintenance and defence, cost millions to provide. On the other hand it is shown that there are more than 1,500 locations of water suitable for use by flying boats and seaplanes within the areas covered by aeronautical charts of the United States alone. Water take-off and landing runways cannot be blown up and usually offer more area and fewer obstructions surrounding them. It is suggested that large troop-carrying flying boats would combine advantages of load, range, and wider choice of landing facilities. A comparison of armament and performance with large land aircraft is also given. *The Consolidator*, Christmas Issue.

Pacific Airmotive's New Catalogue

Thirteenth issue of the Pacific Airmotive catalogue, listing hundreds of airplane parts, supplies, accessories and materials. The book also contains a description of company repair shops, for the service of propellers, instruments, radio and electrical equipment, offered in addition to their regular airplane and engine maintenance service. Pacific Airmotive Division of Airplane Manufacturing and Supply Corporation.

Hydraulic Equipment Handbooks

Aircraft Accessories Corporation has issued four new combination-parts catalogues and instruction handbooks on aircraft hydraulic equipment manufactured by the company. The four manuals, punched for loose leaf binder, cover swivel joints, brake control valves, selector valves and actuating cylinders. Each gives details of construction, functions and operation of equipment involved. Installation, inspection, maintenance adjustment and trouble shooting are also treated. Sectional drawings are included with an itemized list of parts and their order numbers. Aircraft Accessories Corporation.

The 1941 Monocoupe

Catalogue presenting the 1941 Monocoupe. An elaborate booklet which not only offers complete data on the new Monocoupe, but also presents a strong case for private flying. Details of construction, performance, range, and cost of operation over a two-year period are given. *The 1941 Monocoupe.*

Lockheed Specification Engineering

Specification Engineering Group. An outline of the work done by the specification engineering group at Lockheed Aircraft Corporation. This unit must not only write general airplane specifications, but also special specifications for individual customers. Organization and functions of the group are described. *Lockheed Aircraftsman*, December.

Aerodynamics at Consolidated

Aerodynamic Advances. Harry Sutton. Discussion of improved performance of Consolidated flying boats and bombers, made possible by the adoption of the airfoil known as the Consolidated-Davis airfoil. The new wing is being used with the Model 31 twin-engined flying boat, and the Model 32 four-engined bomber. Aerodynamic improvements such as a new wing flap, the elimination of external bracing and other forms of parasitic drag are also mentioned. *The Consolidator*, Christmas Issue.

New Buildings at Wright Field

Descriptions of the power plant laboratory and the wind tunnel, now being completed at the Army Air Corps Materiel Division base at Wright Field, Dayton, Ohio. The new engine testing equipment will be able to handle units up to 8,000 hp. and simulate altitudes up to 30,000 feet. The 400 m.p.h. wind tunnel, now taking form, will be powered by a 40,000 hp. electric motor. *Air Corps News Letter*, December 1.

C.A.A. School Rating Manual

The latest manual prescribing the minimum in facilities, equipment, personnel and curricula which must be provided by a civilian aviation school in order to be eligible for rating and certification. *Civil Aeronautics Manual 50*, Department of Commerce.

Conduit Fittings

A new group of fittings for aircraft conduit and electrical connector applications in accordance with U.S. Army-Navy Standards is announced by American Phenolic Corporation. This

The American Phenolic Corporation's new aircraft conduit fitting.

line of aluminum alloy fittings comprising 12 classes or 130 pieces is available for Army-Navy standard rigid or flexible aluminum conduit from $^3/_{16}$ in. to $2^1/_2$ in. Accurate threads and the marking of part and size numbers on each item are two of their desirable features. The formed aluminum ferrules, AN3050, AN3051, and AN3052 are fastened to flexible aluminum conduit by a roller crimping method. American Phenolic Corporation.

Flight Engineer

New Figure. Description of the duties of the flight engineer aboard the Pan American Clippers. Similar to that of the chief engineer of an ocean liner, his duty is to see that power plants and structure are in perfect condition every moment of the flight. Operating efficiency, supervision of equipment and recording complete data in logs and charts, demand his closest attention. The selection and training of Pan American flight engineers is also outlined. Pan American Airways *New Horizons*, December.

Aviation in San Diego

Survey of aviation in San Diego, prepared by the San Diego Chamber of Commerce. Issued as an illustrated booklet, it shows a map of the city and harbor with locations of aircraft manufacturing plants, military and naval air bases. First part of the booklet deals with some of the advantages offered by San Diego to aviation in the way of climate, location and potential markets, followed by historical facts about famous flights and events originating in San Diego. Two pages are given to a summary of naval and military aviation facilities, and the remainder is devoted to airplanes and products of San Diego plants. These include Consolidated Aircraft Corporation, Ryan Aeronautical Company and School of Aeronautics, and the Solar Aircraft Company. *The Aviation Industry Looks to San Diego.*

Tooling for Production

Aircraft Tooling. . . Phil Koenig. Description of the tooling procedure at Consolidated Aircraft Corporation. Tool planning and design is divided into five group activities, (1) The Sheet Metal Group, (2) The Special Machinery Group, (3) The Big Fixture Group, (4) "Trouble Shooting" or Shop Liaison Group, and (5) The Machine Shop Group. Details and uses of several types of machine tools are given. *The Consolidator*, Christmas Issue.

Research at Douglas

A report on tests to determine the overload current capacity of the contacts of relays, conducted by F. Foulson of the Douglas Aircraft Co. Comparative tests between contacts made of silver, Carter and Mallory G-17 metal installed in the same type relays, showed that the relay equipped with the G-17 contacts did not stick under overload due to pitting or fusion of the contacts. Leach Relay Company.

Pictures, Not Bullets

The Machine Gun Camera. A description of the Fairchild CG16 Machine Gun Camera, frequently used in place of a regulation machine gun for the training of military pilots and gunners. Equipped with an F/3.0 lens and a rotary disc type shutter, this camera gives an accurate record of the score of each student gunner, by means of a reticle or bull's eye and cross hair system. This tells the scoring officer the position of the target in respect to the path of the imaginary bullet, the correctness of the "lead" or compensation allowed for the velocity of the aircraft and the bullet as well as the distance of the airplane from the target. *Bausch & Lomb Magazine*, December.

Many Aluminum Alloy structures, heretofore assembled by riveting, are now being spot welded with complete success. The results, in many instances, are cleaner construction, more rapid production, and lower assembly costs.

Progress in the spot welding of Aluminum has been rapid during the past two years. Research has developed accurate welding techniques. Machines are now available which give exact regulation and synchronizing of pressure, current and timing. Strong, dependable spot welds are made on a production basis.

Practically any of the Aluminum Alloys in common use can be spot welded to give uniformly strong and efficient joints. Alcoa engineers welcome the opportunity to advise you on the welding of Aluminum. Write ALUMINUM COMPANY OF AMERICA, 1980 Gulf Building, Pittsburgh, Pennsylvania.

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To meet the needs of the National Defense Program, plus the normal demands of peace, a vast expansion of our already greatly increased production capacity is being speeded. When the emergency is past, there will be more Aluminum available than ever before.

Meanwhile, if you can't get all the Aluminum you want when you want it, remember Aluminum is helping you by helping to meet the National emergency.

ALCOA ALUMINUM

Plywood in Aircraft

A collection of material from various sources has been assembled by the Haskelite Manufacturing Corporation on the subject of aircraft plywood for the benefit of engineers and aircraft builders. The book opens with a weight table of the various types of plywood. This is followed by tables on tensile strength, bearing strength and bending characteristics. Engineering bulletins on the bending and moulding of Haskelite and plymetl, on Haskelite as an engineering material and a general discussion of plywood in the aircraft industry are offered with a bibliography on wood and plywood. Department of Agriculture data is given on the bearing strength of wood at angle to the grain and electrical moisture meters for wood. The next section compares the shear strength and stiffness of a wing spar built up of a Haskelite web and spruce flanges with that of a solid I spar. Several magazine articles on the use of plywood in aircraft are also reproduced. *Haskelite Aircraft Plywood.*

Notes on First Aid

Tabloid First Aid. This booklet contains a general outline of first aid methods as well as a description of the various types of first aid kits manufactured by this company. A supplement is devoted to the Aero-Kit, a special unit designed for aircraft. This is packed in an aluminum case in order to save weight. Burroughs Wellcome & Co.

Design and Drafting Training Needed

Engineering and Drafting Problems. B. W. Sheahan. Causes for delay in getting out necessary engineering releases to the production department are discussed. The suggestion is made that college engineering men be given more studies in design and drafting. *The Consolidator,* Christmas Issue.

Chemical Engineering Book Catalogue

Catalogue of books on chemistry and related subjects, which lists 153 volumes, together with their tables of contents. Included are works on alloy steels, plastic, motor fuels, and other subjects of interest to the aeronautical engineer. *Let's Look it Up,* issued by the Reinhold Publishing Corporation, New York.

Sixteen Years of Flying

Test Flying Then . . . and Now. William B. Wheatley. Chief test pilot for Consolidated Aircraft Corporation describes some of the types of airplanes and engines flown since he was an Army Flying Cadet in 1925. *The Consolidator,* Christmas Issue.

Navy Air Strength

The Naval Aviation Expansion Program. Rear Admiral J. H. Towers, U.S.N. Analysis of the air expansion program for the Navy. Numbers of aircraft, bases, aircraft carriers and auxiliary craft are listed, and the important part that long range flying boats will play in future operations is outlined. *The Consolidator,* Christmas Issue.

Recording Performance by Photography

The method used by the Materiel Division of the U.S. Army Corps for recording landing and take-off characteristics of new airplanes. The theodolite method formerly used depended heavily on the skill of the observer and required tedious calculation. This has been supplanted by a system of photographic recording. Equipment consists of a moving picture camera equipped with a built-in stopwatch. The exposure speed has been slowed down from 20 to 3 exposures per second. Additional equipment consists of 30 standard flags placed at intervals of 100 feet. The camera is located 1,500 feet distant on the perpendicular bisector of the course. An anemometer is also used in these tests. Continuous pictures taken of the take-off and landing reveal the true performance of the airplane when checked against the time and wind conditions. *Air Corps News Letters,* December 15.

Army Air Needs

Problems of the U.S. Army Air Corps. Lieut. General Henry A. Arnold, Deputy Chief of Staff for Air. The present expansion program of the U.S. Army Air Corps is described. Capacity of development and manufacture, and the lessons of the war in Europe are discussed. Problems of equipment, production and personnel are outlined together with recent steps made to solve them. *The Consolidator,* Christmas Issue.

Brain Wave Experiments

An account of a series of tests on the electrical impulses or waves emanating from the human brain, conducted by aero-medical research experts at Wright Field, Dayton, Ohio. These experiments were conducted to obtain new data on the functioning of the body at high altitudes. Using the electroencephalograph, an instrument used to measure the brain waves, twelve different subjects were placed in the pressure chamber, where their reactions could be checked under controlled conditions. Purpose of these tests is to weed out applicants not physically fit for flight training. *Air Corps News Letter,* December 15.

Ice on Fighting Airplanes

The Air War Against Ice. John Cashel. A study of the influence of icing conditions on military aviation. The writer points out that if the anti-aircraft and intercepter units know the height of the freezing level, they will be able to know at what altitude to expect invading aircraft. *Bulletins from Britain,* December 11, 1940.

Girl's College Offers Flying Course

Gulf Park College for women has added a course in aviation to its present curricula. The ground course is being taken by eighteen students, six of whom are receiving flight training. Richard G. Cox, president of the school, is in charge of the ground school course. *Chicago & Southern Air Line News,* December.

Modern Stress Analysis

Stress Analysis. Roy A. Miller. Explanation of stress analysis for the general reader. What it is, and why it is necessary, is outlined, together with many easily understood examples of where and how it is applied. It is stated that a stress analysis today may require eight thousand hours to prepare. Vibration, flutter and fatigue loads are also discussed. *The Consolidator,* Christmas Issue.

Vibration-Detecting Equipment

Special equipment for the detection of vibration in aircraft engines has been purchased by the Lycoming Division of the Aviation Manufacturing Corporation for testing light engine installations under actual operating conditions. The newly acquired equipment, formerly used only on the larger Lycoming power plants, not only detects all vibration but separates vibration components for study by the engineers. *The Lycoming Star,* December.

New Geodetic Trainer

A new trainer of geodetic construction, designed and built as a class project by students of the Aero Industries Technical Institute, Los Angeles, is undergoing test flights for its approved type certificate. Production is planned by the Plexweve Aircraft Corp. Aero Industries Technical Institute. *The Plane Builder,* December.

Distaff Side

A Woman's Views on Aviation. Jacqueline Cochran. Experiences in the first stage of the London-Melbourne race in 1934. Progress in safety and dependability made in the past few years is given, together with a commentary on women's place in aviation during the next few years. *The Consolidator,* Christmas Issue.

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Durable Coatings that Dry in Minutes

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TO meet the aircraft industry's urgent demand for faster drying and still more durable coatings, Bakelite Corporation has developed a unique group of synthetic resins known as BAKELITE Dispersion Resins. They not only accelerate drying time—in some instances to *less than one minute*—but impart to protective finishes greater resistance to moisture than is obtainable with most other high-quality aircraft coatings.

Here are some of the outstanding results that have been obtained with coatings based on these dispersion resins:

★ Aircraft primers that dry to recoat with nitro-cellulose lacquers in only 5 minutes.

★ Ten-minute air-drying anti-corrosive primers that withstand 2½ years of outdoor exposure . . . even without top coat.

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★ An aircraft finishing system ready to handle in ten minutes; durable and corrosion resistant—consisting of a chromate dispersion primer coat followed by a dispersion resin aluminum enamel.

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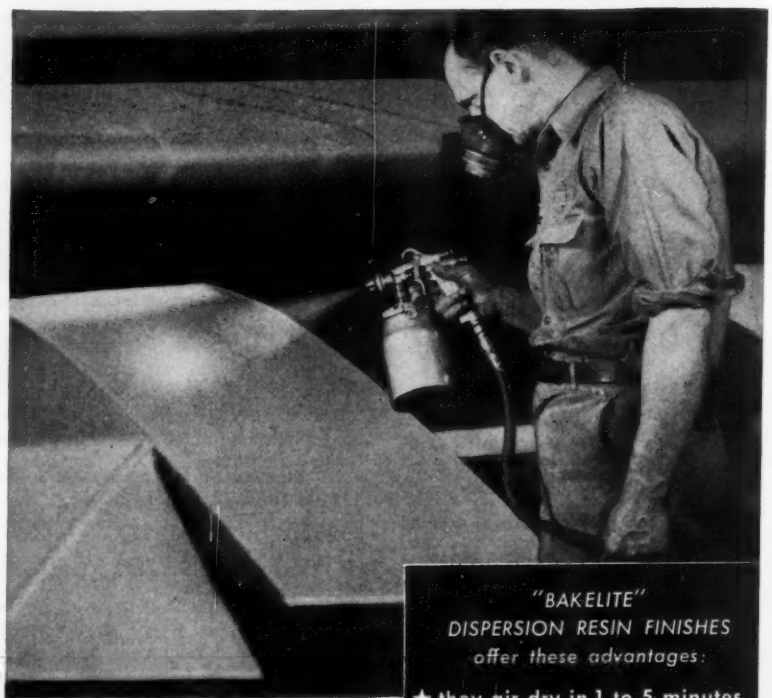

"BAKELITE" DISPERSION RESIN FINISHES offer these advantages:

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RESINS FOR PROTECTIVE COATINGS

Catalogue of Aviation Uniforms

Booklet issued by the Russell Uniform Co. of New York. Described as the only uniform catalogue devoted solely to aviation, it lists and illustrates uniforms and equipment for military, naval and airline officers and personnel. *Aviation Uniforms.*

Future Export Business

Still on the Export Beam. Irving H. Taylor. Despite the current emphasis on war markets and military aircraft production, commercial aircraft export business has more than doubled over the 1939 high, according to the writer. A plea is made for the stabilizing influence of this business and its continuance. Of especial interest is a page of drawings showing commercial adaptations of present types of Consolidated military aircraft. *The Consolidator*, Christmas Issue.

Aircraft Bearings

A new catalogue containing sectional drawings and specifications of the complete line of aircraft ball bearings manufactured by the Fafnir Bearing Company.

United Establishes a Pilot School

United Air Lines announces a new pilot training school at Tracy, California, operating as a division of the Boeing School of Aeronautics. Engineering students who have completed two years of college and the second stage of the CPTP are given four months of instruction at Tracy. Those qualifying are given instruction in multi-motored equipment at the Boeing School at Oakland. The graduates who pass the strict school tests as well as the government examination are assigned as United Air Line co-pilots. *United Air Lines News*, November.

Military Aircraft Compared

Germany and Ourselves. F. A. Firth. A resident technical officer of the British Purchasing Commission discusses relative merits of British and German military aircraft. The German fuel injection system is described, in addition to other German features of design which differ from English or American types. It is stated that close touch will be maintained with British squadrons which will receive the new Consolidated bombers, to secure performance data under combat conditions. *The Consolidator*, Christmas Issue.

Don't Conceal Mistakes

Your Brother's Keeper. Capt. S. J. Zeigler, U.S.N. The naval inspector at Consolidated Aircraft Corporation emphasizes the fact that the lives of brave men and hard-won company reputations depend upon workmanship, and the first commandment of the aircraft worker—don't conceal mistakes. *The Consolidator*, Christmas Issue.

Machine Tools

Discussion of machine tools, their development and the important role they play in modern industry. Various operations are described, together with improvements which have been made in speed, accuracy and control. Personnel requirements and the importance of machine tool manufacture as a basic industry are also discussed. *Shell Progress*, December.

Valve Steels

A study of the problem of selecting steels for the manufacture of valves for internal combustion engines. The properties of the two general types of material which can be used are discussed. Wilcox-Rich Division of the Eaton Manufacturing Co. *Hard Facts*, December.

Wing Flaps

The Fowler Flap and Its Possibilities. Harlan D. Fowler. History of the development of the Fowler flap principle from its conception in 1916 to the present. It is being used on the new Consolidated Model 31 flying boat. *The Consolidator*, Christmas Issue.

Invisible Light for Night Flights

A description of the system of fluorescent lighting used to illuminate the instrument panels of Army airplanes. This method provides adequate illumination without causing eyestrain. *Army Air Corps News Letter*, December 1.

Additional Aircraft Instruments

Additional pages for the loose leaf catalogue of Manning, Maxwell and Moore Inc. These pages contain description, three view drawings and specifications of a manifold pressure gage, an engine thermometer, a torque indicator, a duction gage, and a fuel pressure gage, Manning, Maxwell & Moore. *Aircraft Instruments.*

More 100-Octane Capacity

New equipment is being added to the Los Angeles refinery of The Texas Company for the production of 100-octane gasoline. Using the "alkylation" process, the plant will have a production capacity of ten million gallons a year. *The Texaco Star*, December.

Testing Materials

Notes From the Lab. Tom Galvin. Problems in material testing as outlined by the Chief Chemist of Consolidated Aircraft Corporation. Alloy steels, magnesium alloy castings, hydraulic fittings, plastics and tests for welders are discussed. *The Consolidator*, Christmas Issue.

From the Industry

(*Continued from page 29*)

volved cases such as this, in direct violation of the law."

To combat this "outlawry" in the nation's skyways, Mr. Piper suggests that local and state police officials assume the responsibility which is justly theirs and make all arms of the law aware of flight regulations and prosecute violations. "As it is now, the average pilot fears only the federal inspectors and knows pretty well where these men are. Since there are few of them, pilots feel themselves immune from apprehension and flagrantly violate all safe and sane regulations except on the day the inspector is in town." If every local policeman as well as highway patrolman were ordered to report all violations, there would automatically be a great reduction in accidents.

Reynolds Metals Company

Increasing demands by the Army, and the Navy, and the Aviation industry, have stepped up the Reynolds Metals Company's production of aluminum powder and paste. Considerable aluminum powder is used in the aviation industry. Dropped on the surface of water, aluminum powder forms a "slick." It is reported that foreign aviators use this phenomena to relocate submarines. When the aviator sees a submarine, but is traveling too fast to keep the location in view he drops some aluminum powder to form a "slick." Returning, he can then see the spot where the submarine submerged. Aviators also drop this powder to help them calculate wind drift, and in an emergency landing on the water at night, the reflection of a dropped flare on aluminum powder floating on the surface permits the pilot more precise judgment in landing.

1918-1941

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THE CHOICE OF THE AVIATION INDUSTRY

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Contractors to the United States Army, Navy and Coast Guard and Aircraft Engine Builders

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News Review

December 10. The Navy Department announced that contracts had been let for the construction and equipment of additional plants at the Pratt & Whitney, Hamilton Standard and Vought-Sikorsky Divisions of the United Aircraft Corporation. The title for all of these plants, being built at a cost of $18,160,746, will remain with the Navy.

December 11. Pan American Airways' seaplane, "The Yankee Clipper", flew non-stop from New York to San Juan, Puerto Rico. This was a survey flight which will precede regular service on this route, which is 675 miles shorter than the one used at present, by way of Miami. Permission to operate this flight as regular service has been applied for from the C.A.B.

December 13. A judgment by Judge Edward A. Conger of the U.S. District Court in New York enjoined the Canadian Colonial Airways from operating an intra-state air service serving Buffalo, Niagara Falls and New York. Canadian Colonial started this service without applying to the C.A.B. for permission and maintained, in the court action, that the Federal body had no jurisdiction over intra-state operation of aircraft.

December 13. The Taylorcraft Aviation Corporation demonstrated the covering of a light airplane with fire-resistant fiber glass fabric.

December 14. Canadian Colonial Airways resumed their New York to Albany service after a lapse of two years. The C.A.B. suspended service at that time due to the poor condition of the Albany airport's runways.

December 14. The United Aircraft Corporation announced a five-cent-an-hour salary increase for all employees with the exception of students. This increase affects 17,000 workers.

December 15. The new U.S. Navy aircraft carrier "Hornet" was launched at Newport News, Virginia. Mrs. Frank Knox, wife of the Secretary of the Navy, was its sponsor.

December 15. Henry Ford opened a school for the training of young men as airplane mechanics, in order to supply trained workers in the Ford Company's engine plant which will open in the spring.

December 20. The War Department and the Defense Advisory Commission announced that $20,000,000 in "educational orders" would be given to motor car manufacturers for the beginning of airplane production at these plants.

December 20. Brewster Aeronautical Corporation received a contract totaling $15,160,501 for U.S. Navy airplanes.

December 20. The U.S. Army Ordnance Department announced the production of a 75 mm. cannon which can be mounted on heavy bombers.

December 21. United Air Lines inaugurated a pension plan for all of its employees providing for retirement between the ages of 60 and 65.

December 21. Airplanes were the leading U.S. export during the first nine months of 1940, according to an analysis made by the U.S. Chamber of Commerce.

December 22. United Air Lines announced that it would begin an air freight service between New York, Cleveland and Chicago.

December 23. The Curtiss-Wright Corp. announced the acquisition of the Marmon Co.'s motor car plant at Indianapolis. The factory will be renovated and used for the manufacture of Curtiss electrical propellers.

December 23. Dr. Hugh L. Dryden, chief of the mechanics and sound section of the National Bureau of Standards, was selected by the Institute of the Aeronautical Sciences to receive the Sylvanus Albert Reed Award for his contribution to the mechanics of boundary layer flow and to the interpretation of wind tunnel experiments.

December 24. Workers at both the Newark and the Long Island City plants of the Brewster Aeronautical Corporation sign a contract barring four kinds of strikes for the coming year. The contract also provided for wage increases totaling between $1,500,000 and $3,000,000.

December 27. The War and the Navy Departments opened negotiations to incorporate Pan American Airways facilities in Mexico, Central and South America into the hemisphere defense plan.

December 29. The Ford Motor Company announced that it had started the construction of a million dollar magnesium foundry to turn out castings for the airplane engines to be manufactured by the Ford Company.

December 30. The election of Frank W. Caldwell, director of research of the United Aircraft Corporation, as president of the Institute of the Aeronautical Sciences for 1941 was announced.

January 3. Buick Motor Company received a contract from the National Defense Commission to build Pratt & Whitney engines.

January 4. Fort Worth, Texas, was named as a site for an aircraft assembly plant. Long range bombers, built from parts fabricated at automobile plants, will be assembled there.

January 5. C.A.A. Administrator Donald H. Connolly reported an increase of 205 airports during 1940.

January 6. Dr. W. Bailey Oswald, Chief of the aerodynamic research group of Douglas Aircraft Company, will receive the Lawrence Sperry Award given by the Institute of the Aeronautical Science for analytical studies in aerodynamics which have greatly facilitated the accurate design and economical operation of airplanes.

January 7. The War Department announced that the Wright Aeronautical Corp. would erect a $42,488,548 plant at Lockland, Ohio.

January 7. Amy Johnson was drowned in the Thames Estuary after a parachute descent which she was forced to make while ferrying a R.A.F. airplane.

January 8. Work began on Mexico's first Navy-Air base at La Paz, Lower California.

January 8. Three Boeing flying boats, originally ordered by Pan American Airways, will be delivered to the Royal Air Force to be used as a ferry for pilots delivering bombers to England.

January 9. The Ford Motor Company and the Consolidated Aircraft Corporation will cooperate in the building of the four-engined B-24 bomber. The plan, announced by Major R. H. Fleet, calls for the fabrication of the airplane parts by Ford and their assembly plant now being built at Fort Worth by Consolidated.

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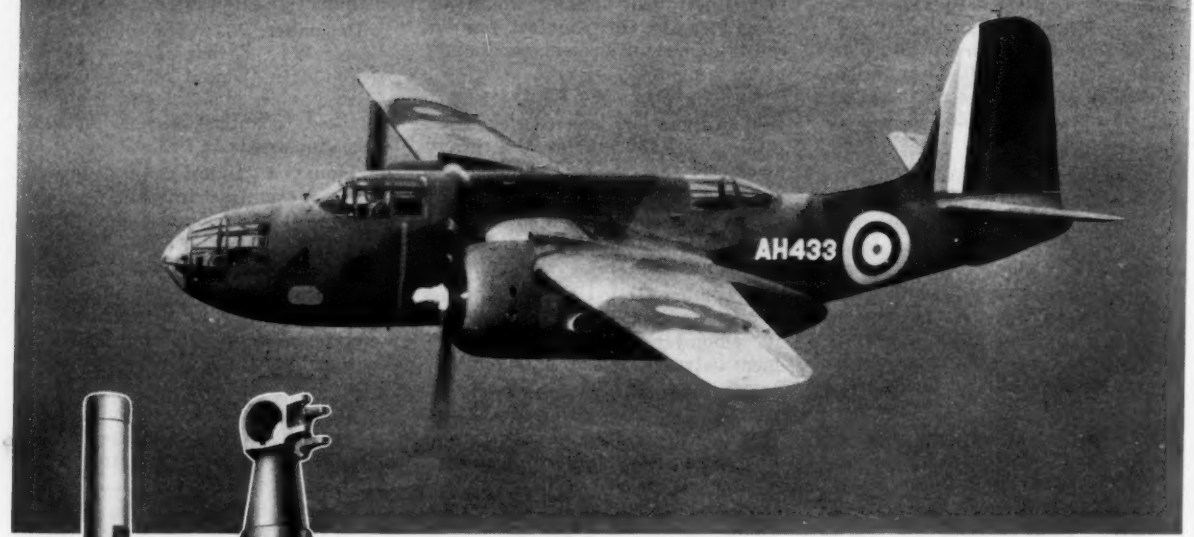

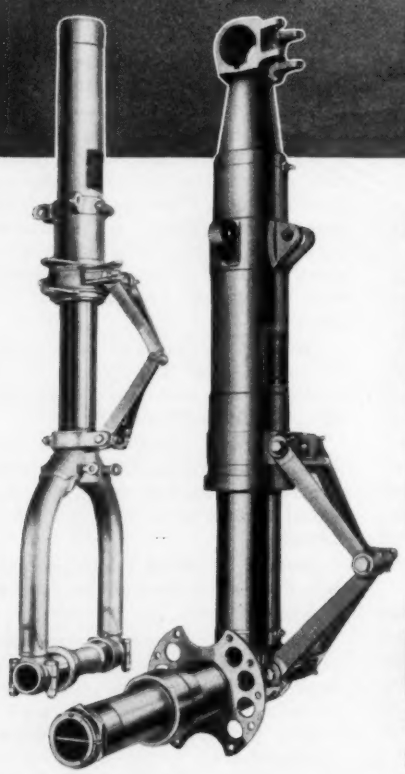

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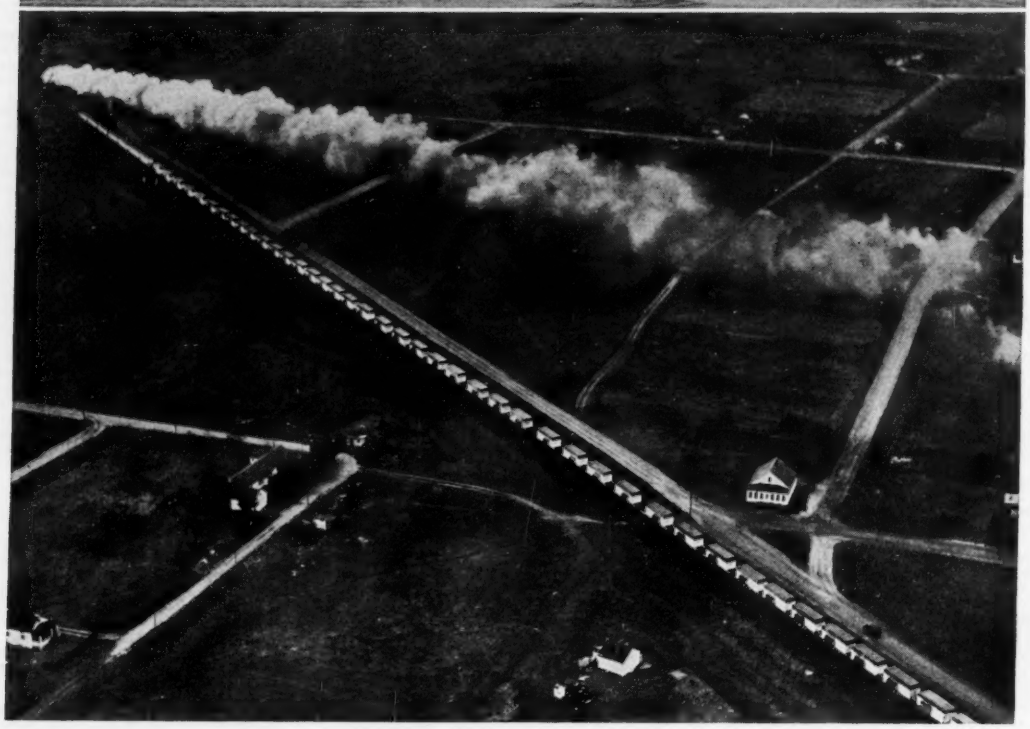

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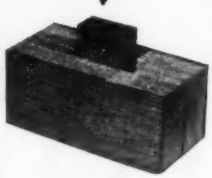

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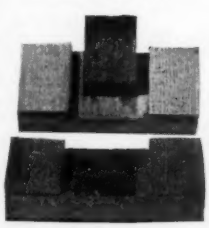

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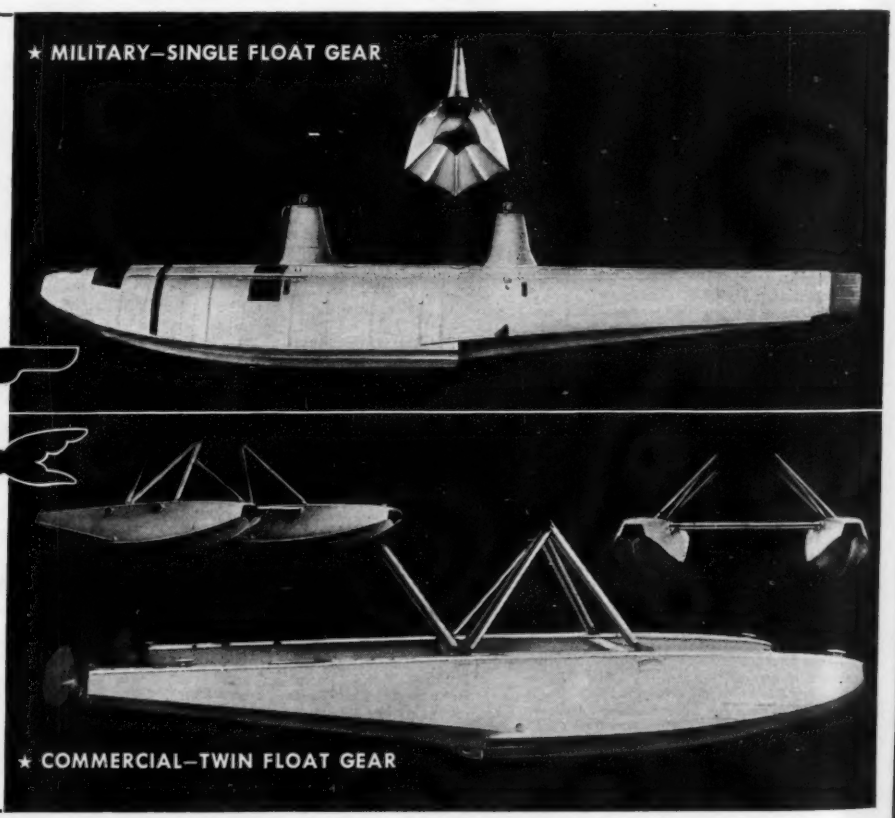

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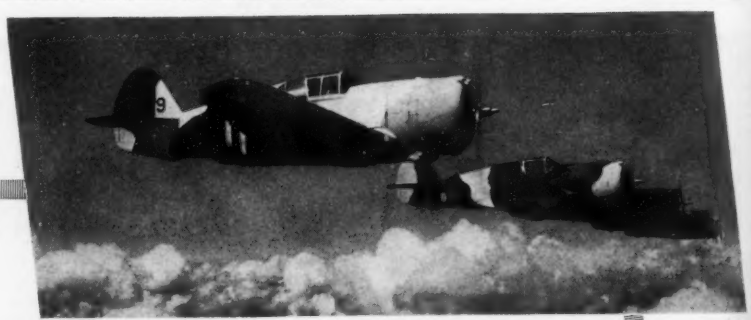

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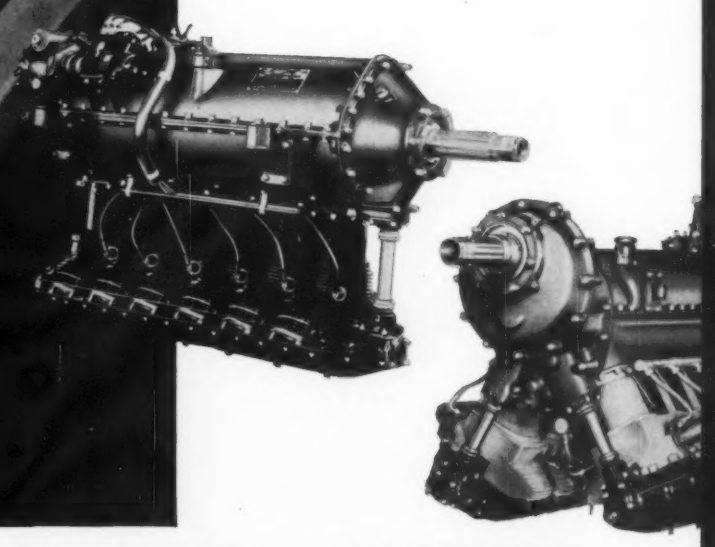

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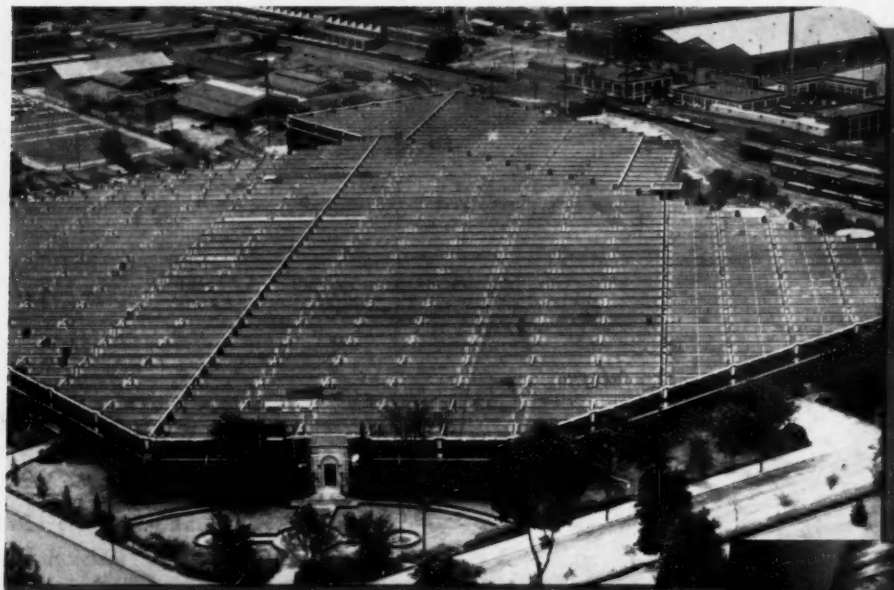

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